

Gas Laws

Volume, Pressure, Temperature: a look at these conditions

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Volume: the amount of space gas particles occupy.
Why can gases be easily compressed?

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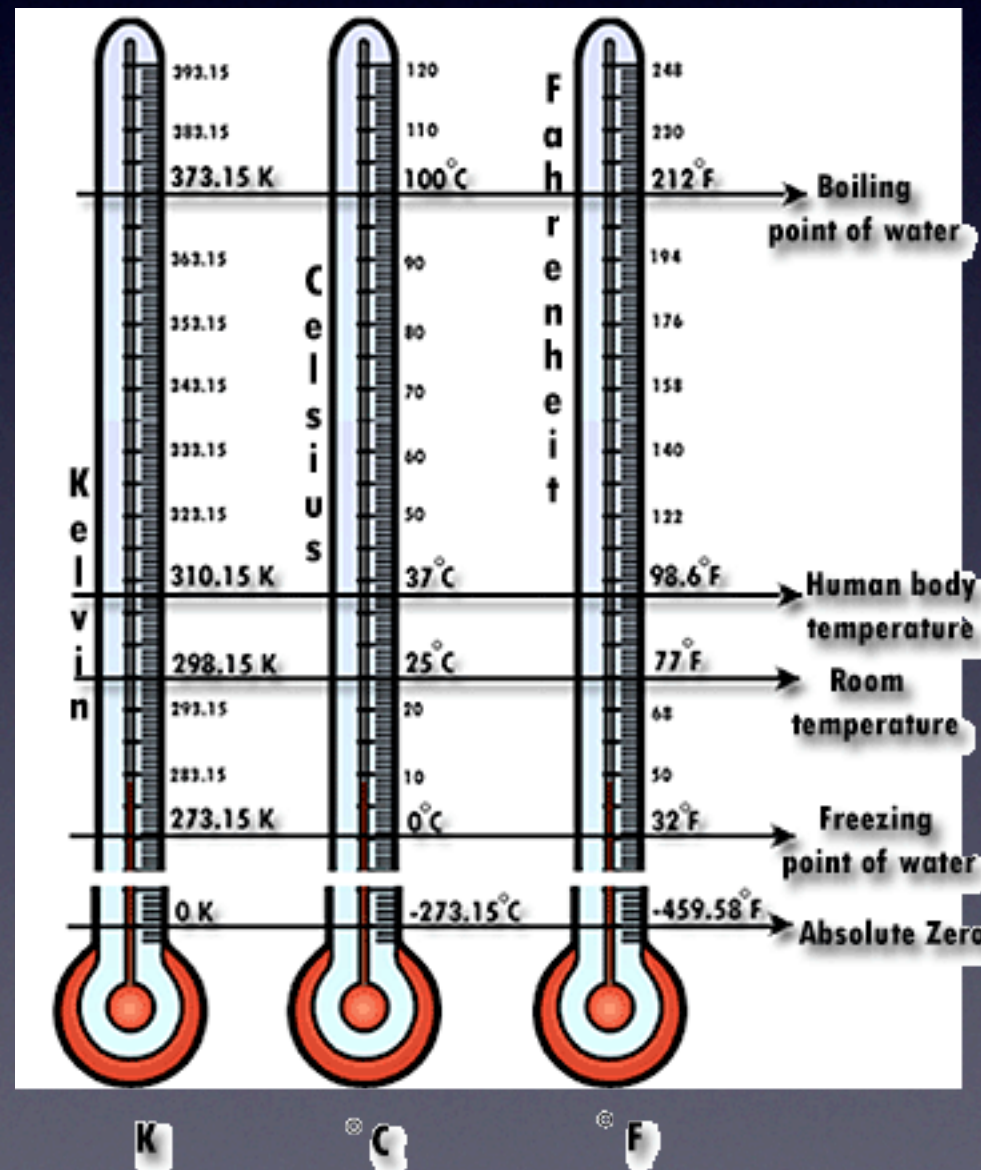
a measure of the
average kinetic energy
of a substance

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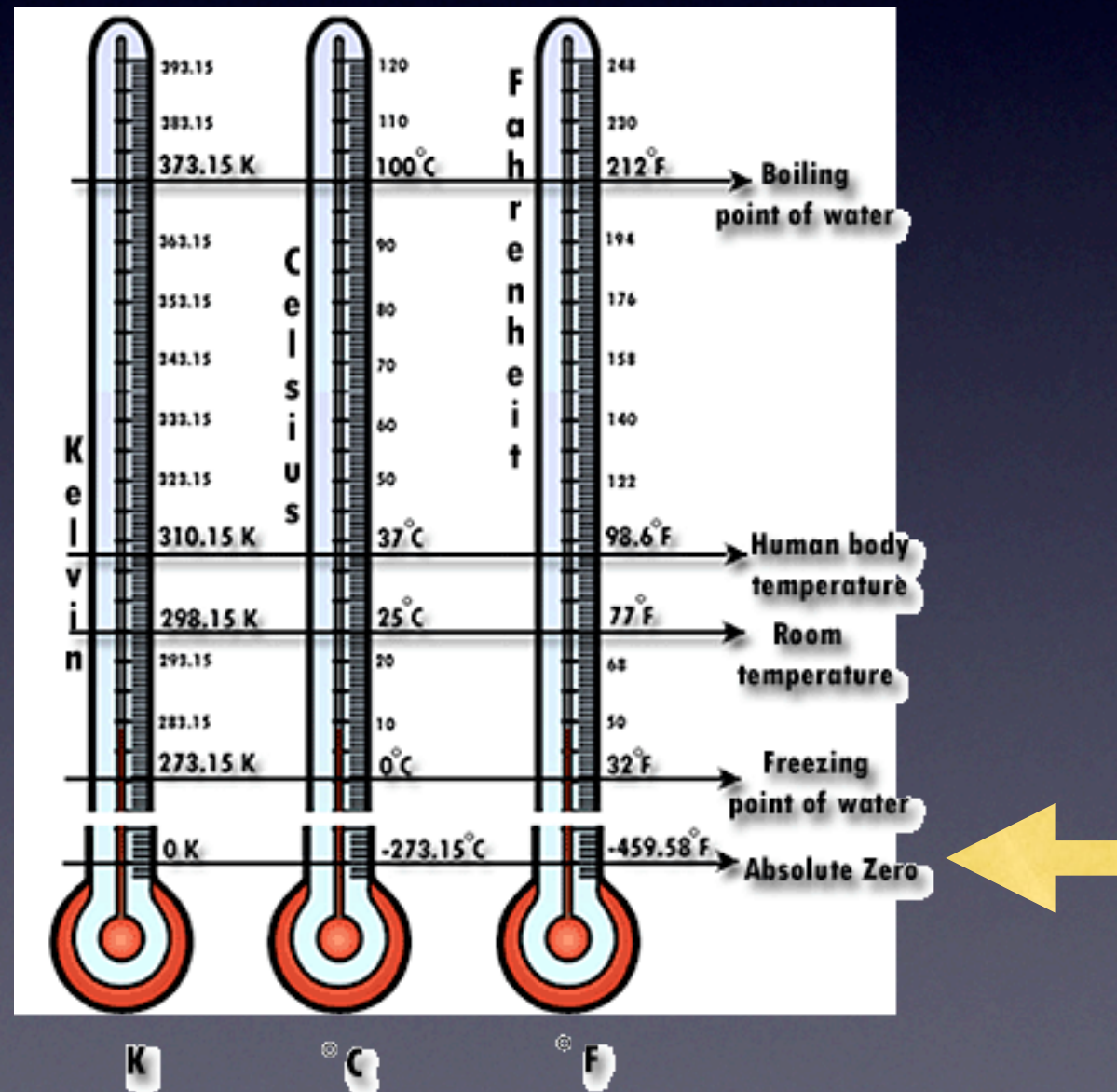


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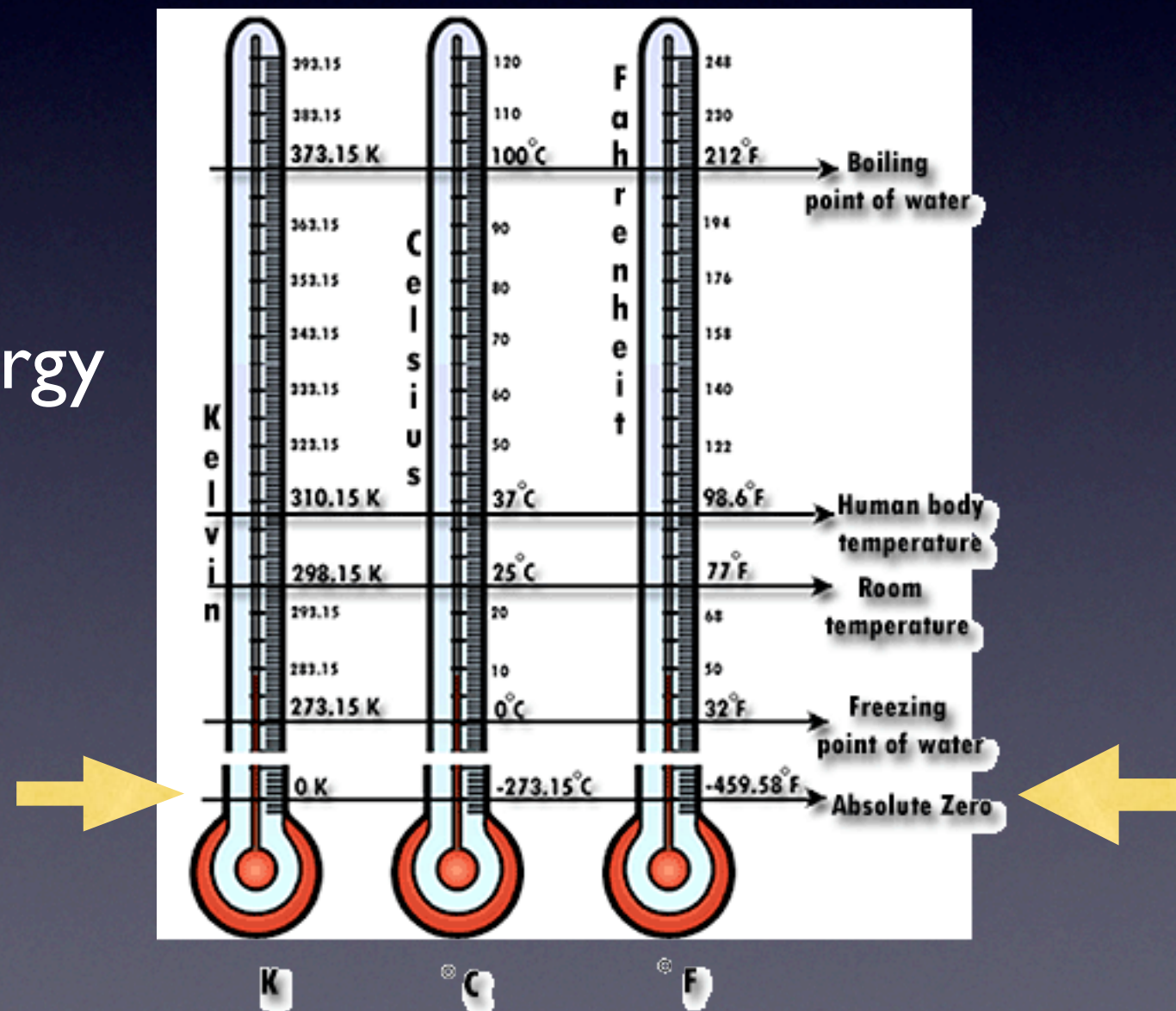


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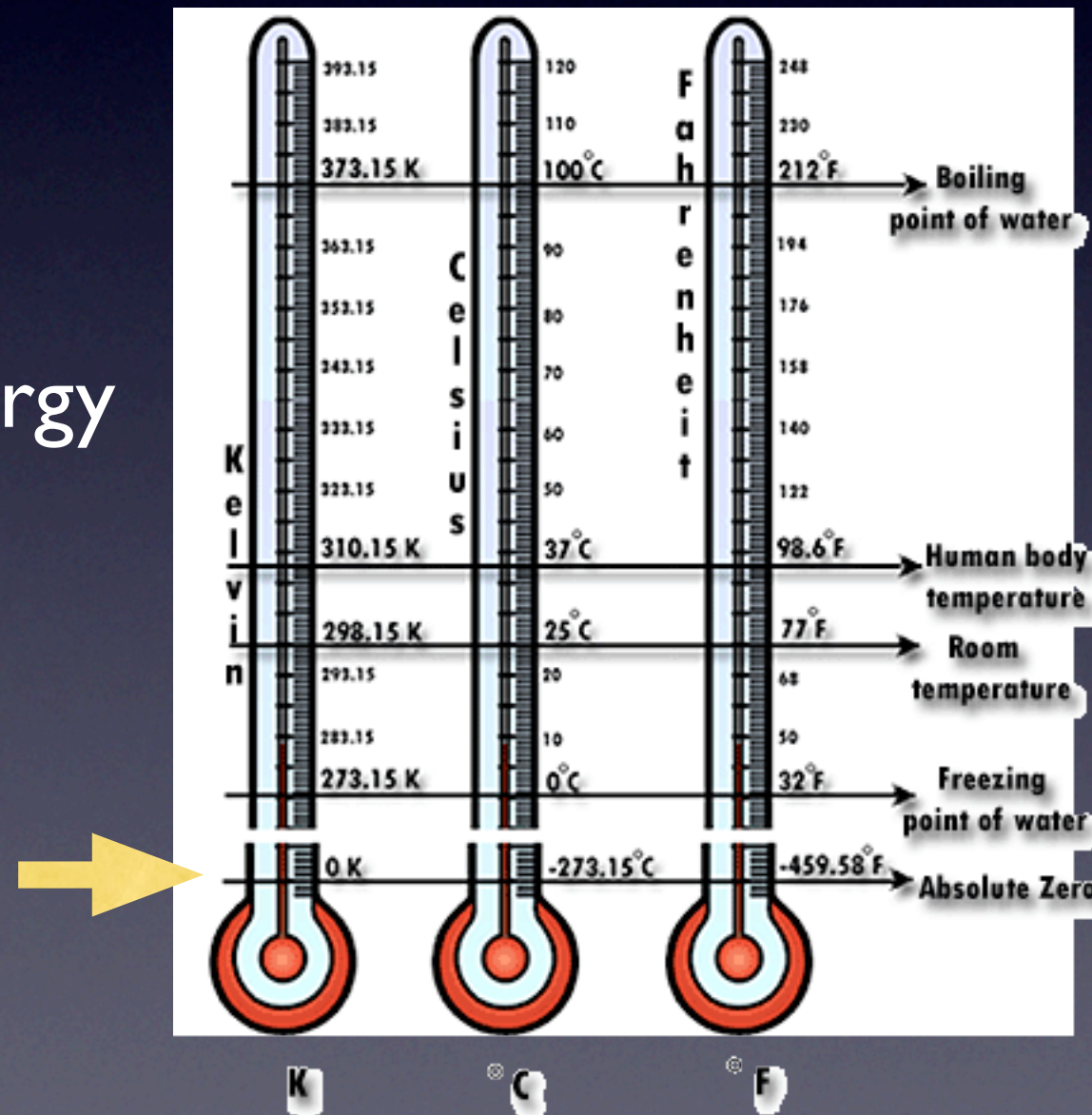


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absolute
zero =
0 K
-273 C

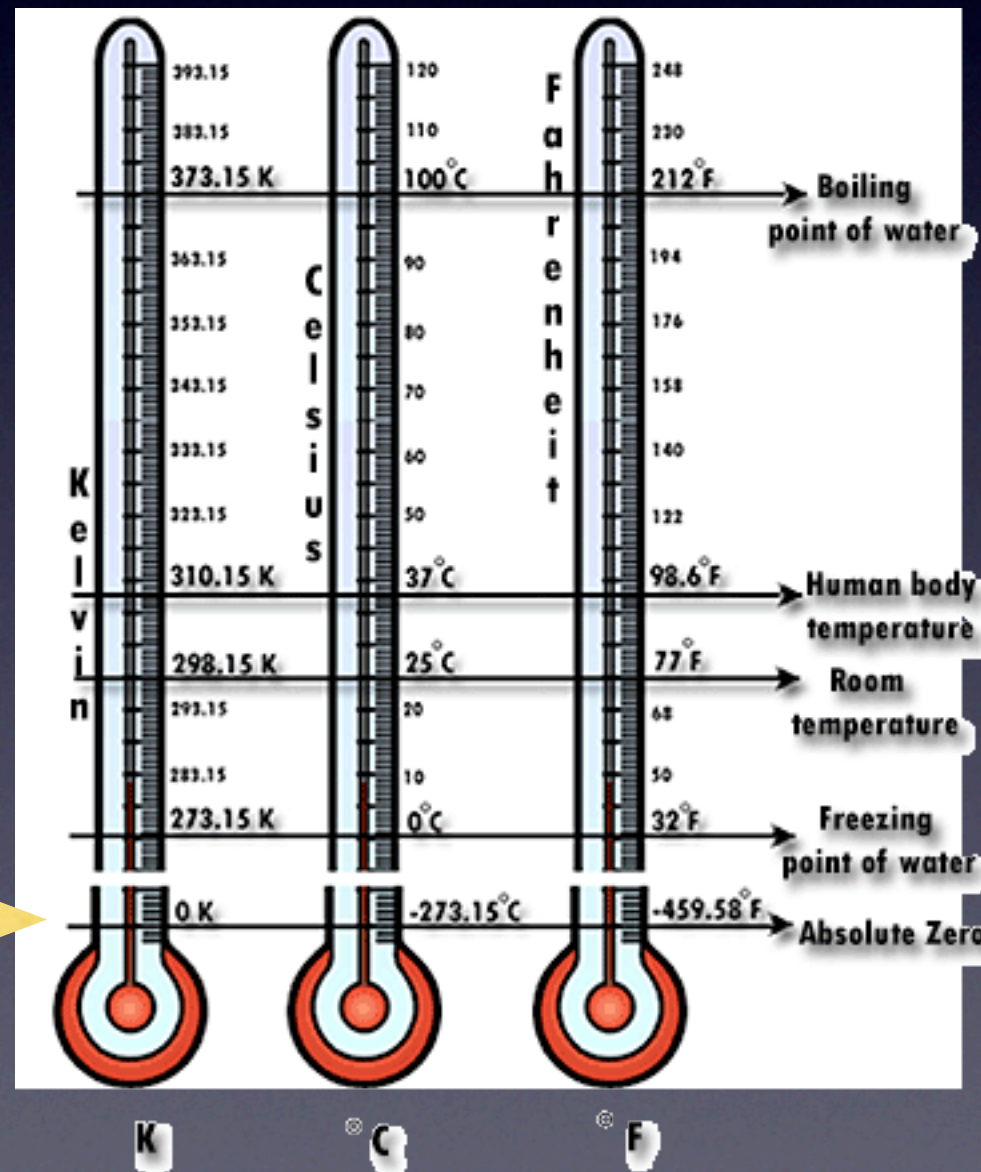
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no particle motion
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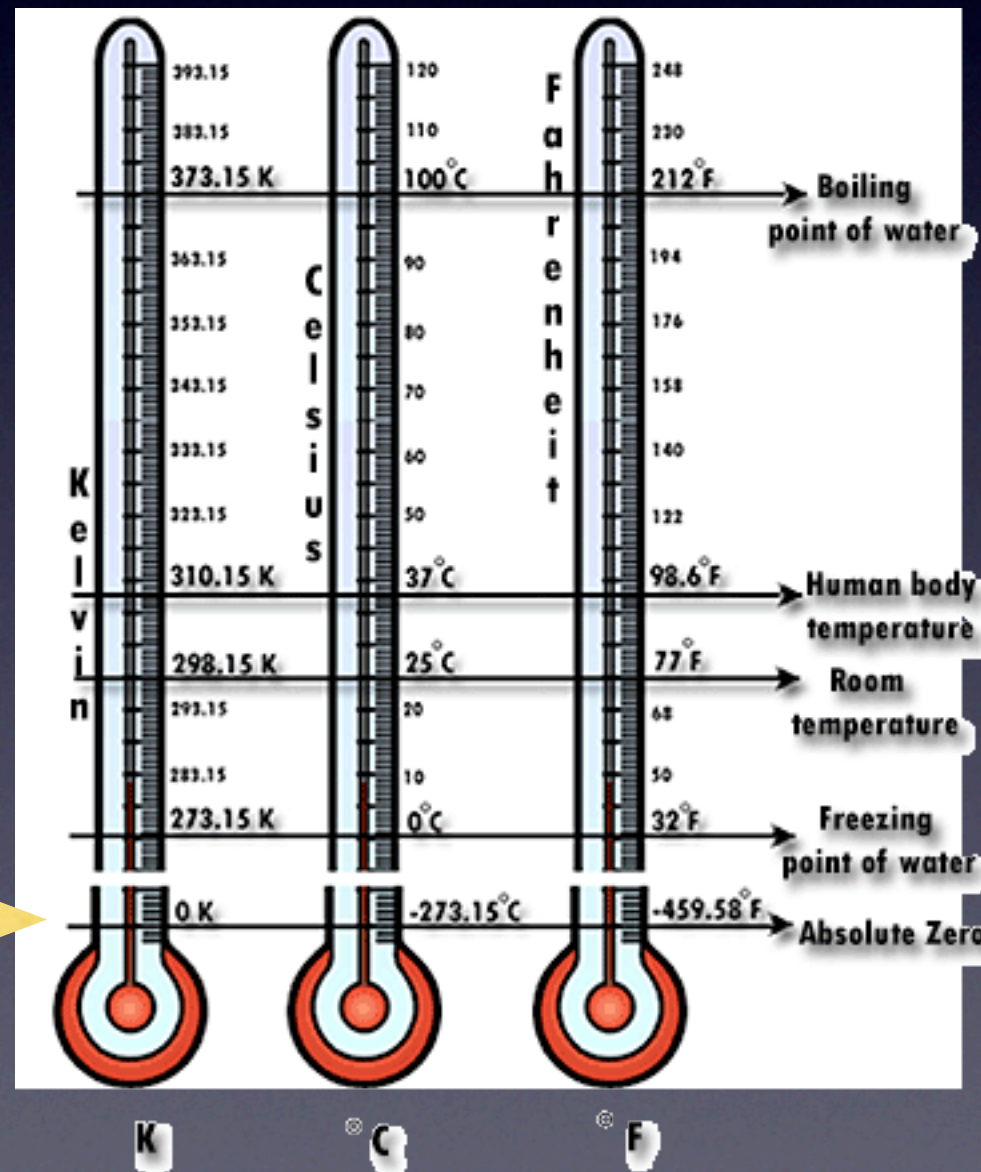
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Only the Kelvin
Scale is directly
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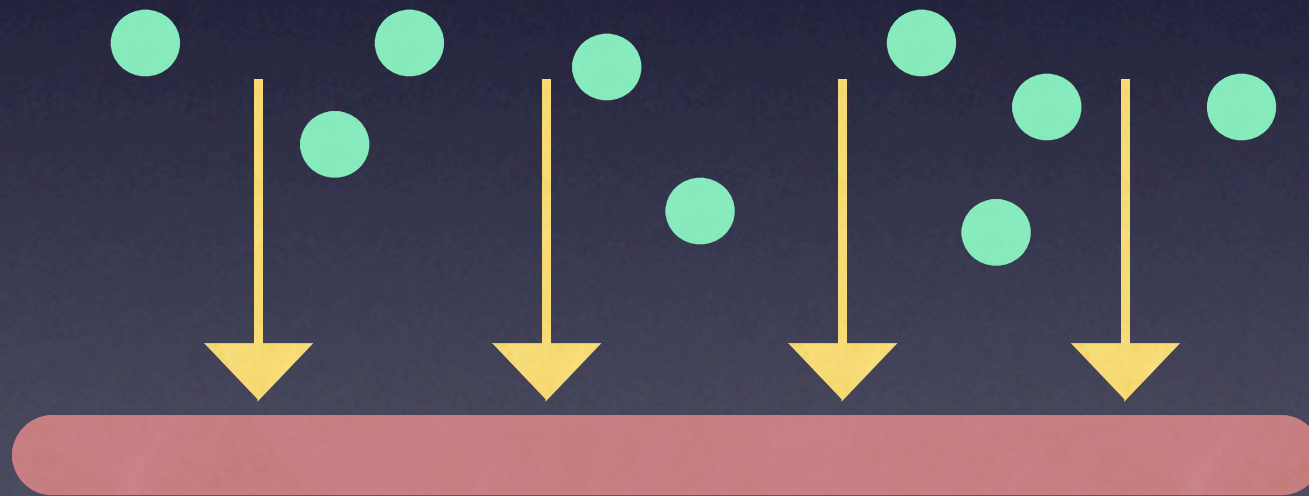
absolute
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pressure:

the WEIGHT of the air

or....

the FORCE of air particles on a surface

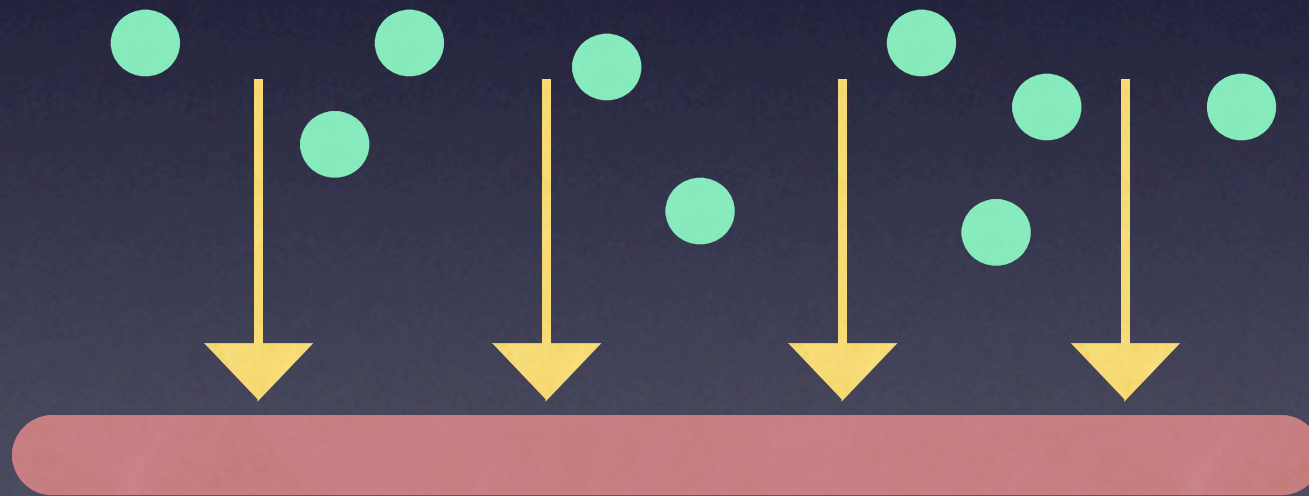


pressure:

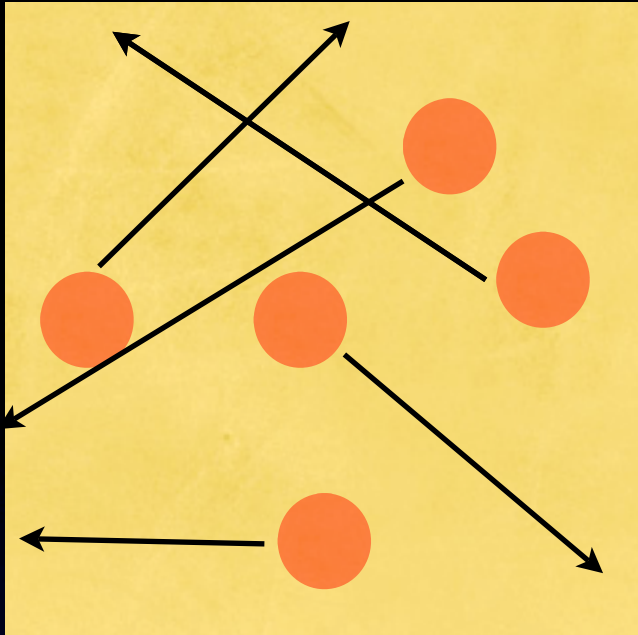
the WEIGHT of the air

or....

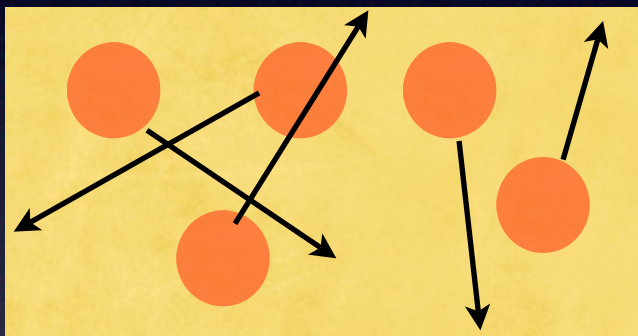
the FORCE of air particles on a surface

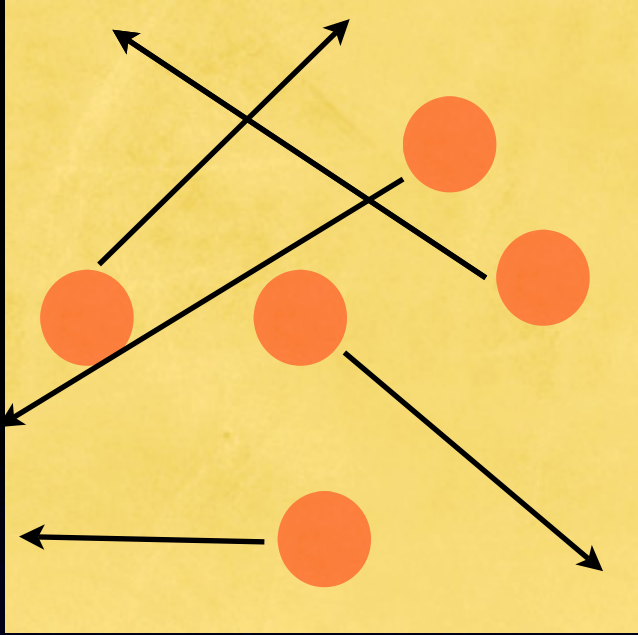


What affects this force?



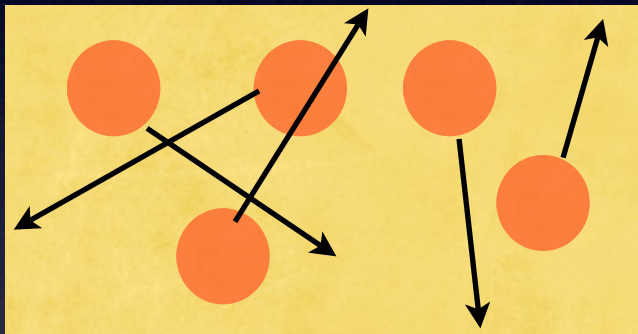
Collisions with container walls create a force, or pressure.

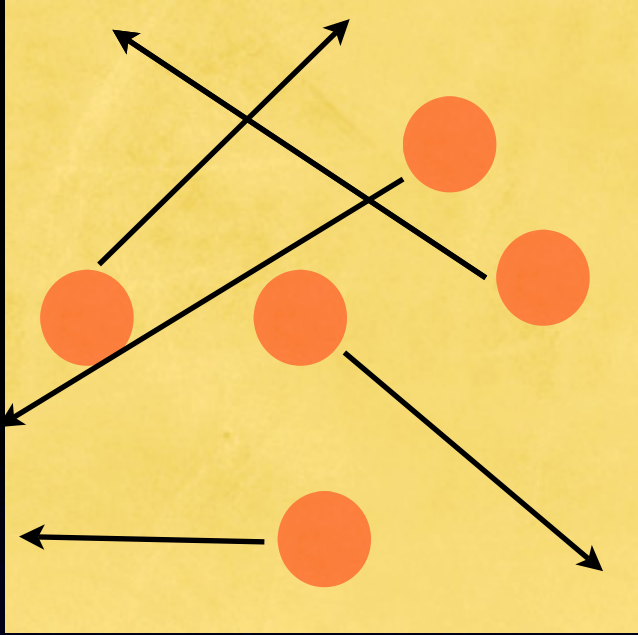




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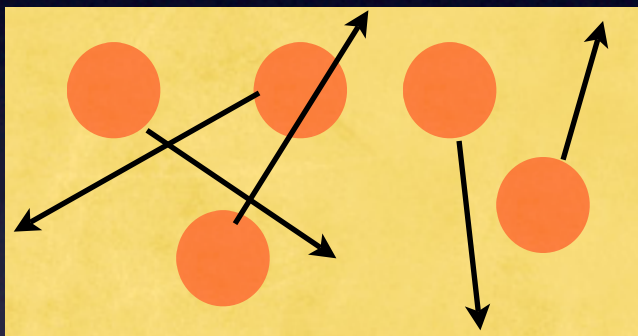
What happens when volume is decreased?



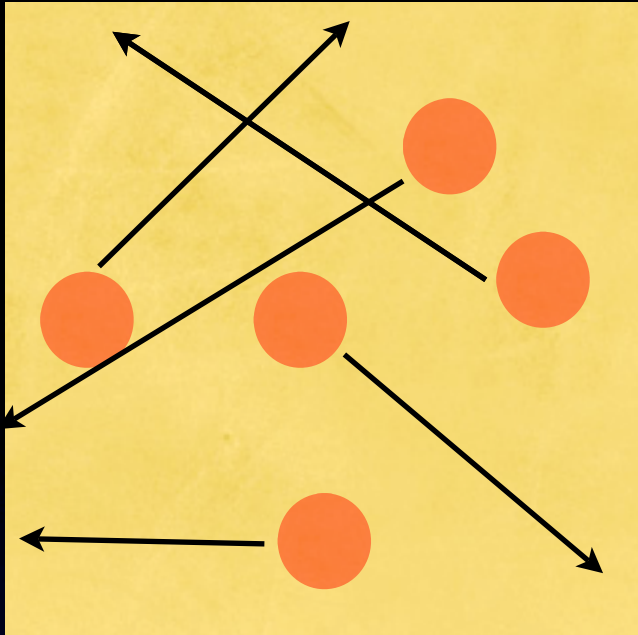


Collisions with container walls create a force, or pressure.

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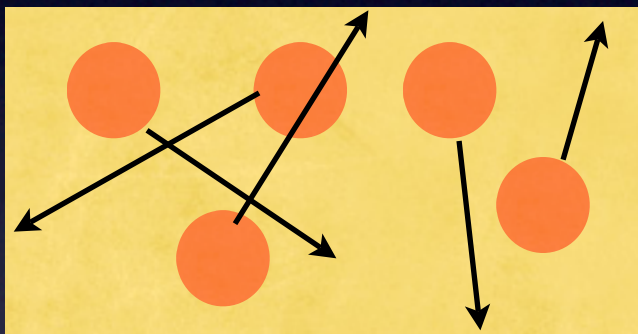


Decreasing the volume increases the number and force of collisions, thus increasing the pressure.



Collisions with container walls create a force, or pressure.

What happens when volume is decreased?



Decreasing the volume increases the number and force of collisions, thus increasing the pressure.

VOLUME AFFECTS GAS PRESSURE!



Where is the air pressure the highest?

Where is the air pressure the lowest?



HIGHEST

Where is the air pressure the highest?

Where is the air pressure the lowest?

A diagram illustrating air pressure on a mountain. The background is a dark blue sky filled with green dots representing air molecules. The ground is a brown mountain with a yellow snow-capped peak. The word 'LOWEST' is written in white at the top, and 'HIGHEST' is written in white at the bottom left. Two red questions are placed on the right side of the mountain.

LOWEST

Where is the air pressure the highest?

Where is the air pressure the lowest?

HIGHEST

A diagram illustrating the relationship between air pressure and altitude. It features a brown, jagged mountain silhouette on the right side. The background is a dark blue gradient, representing the atmosphere, and is populated with numerous small, light blue dots. The density of these dots is highest near the bottom left and decreases as they move towards the top right. The word 'LOWEST' is written in white at the top center, and 'HIGHEST' is written in white at the bottom left. Three red text prompts are placed on the right side of the mountain, and a purple text prompt is located in the middle right area.

LOWEST

Where is the air pressure the highest?

Where is the air pressure the lowest?

What factor here is affecting air pressure?

HIGHEST

A diagram illustrating the relationship between air pressure and altitude. It features a brown, jagged mountain-like shape on the right side, representing the ground. The background is a dark blue gradient, representing the atmosphere. Numerous small, light blue dots are scattered throughout the atmosphere, representing gas particles. The dots are most densely packed near the bottom left, where the word 'HIGHEST' is written in white. As the dots move higher and further from the ground, they become more sparsely distributed. At the top of the diagram, the word 'LOWEST' is written in white. Two red text boxes with white outlines are positioned on the right side of the mountain. The first box, located higher up, asks 'Where is the air pressure the highest?'. The second box, located lower down, asks 'Where is the air pressure the lowest?'. A purple text box is also located on the right side, asking 'What factor here is affecting air pressure?'. Below this purple box, the text 'THE AMOUNT OF GAS (# OF PARTICLES)' is written in purple. The overall layout suggests that as altitude increases, the number of gas particles (and thus air pressure) decreases.

LOWEST

Where is the air pressure the highest?

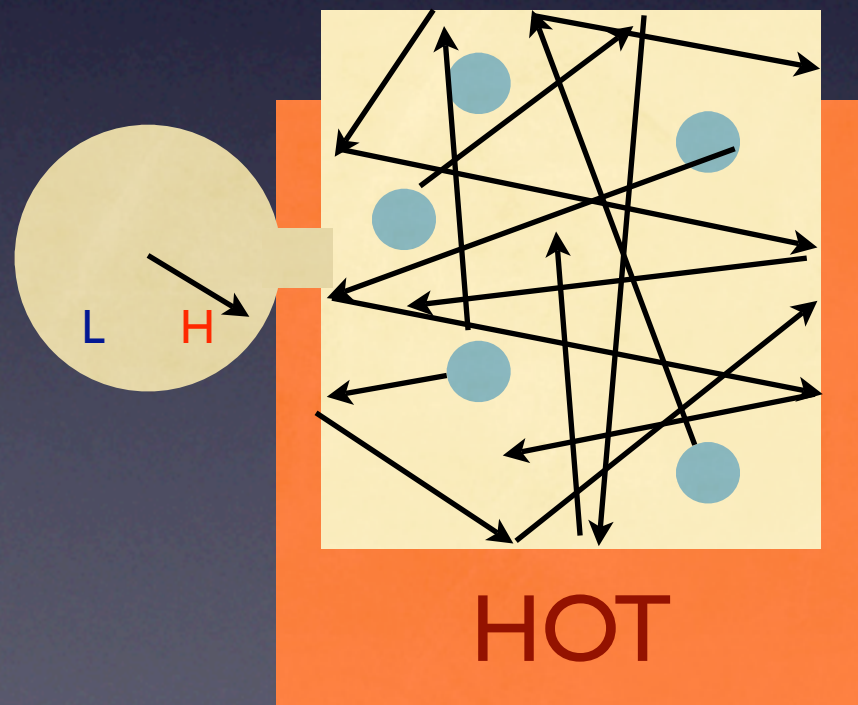
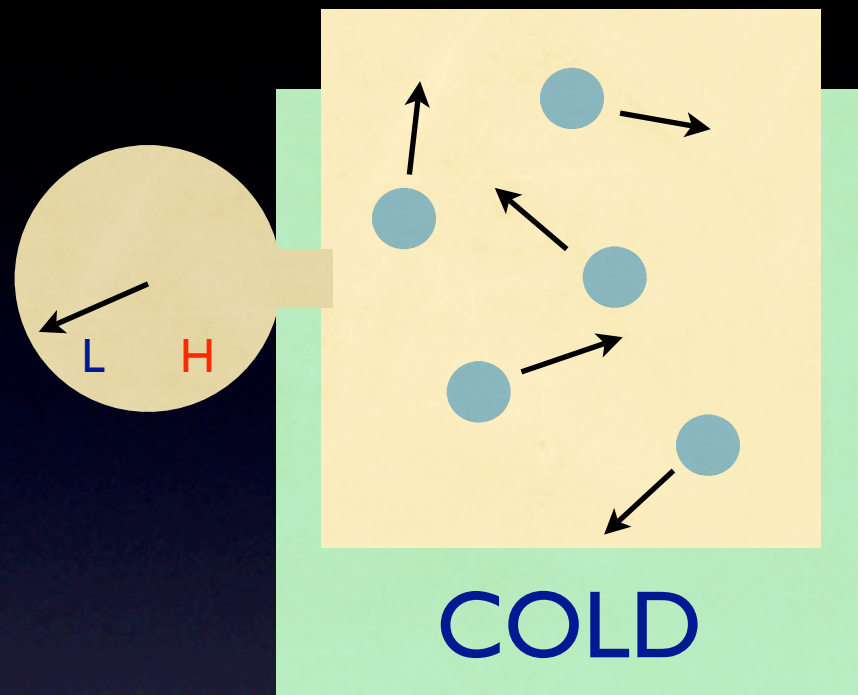
Where is the air pressure the lowest?

What factor here is affecting air pressure?

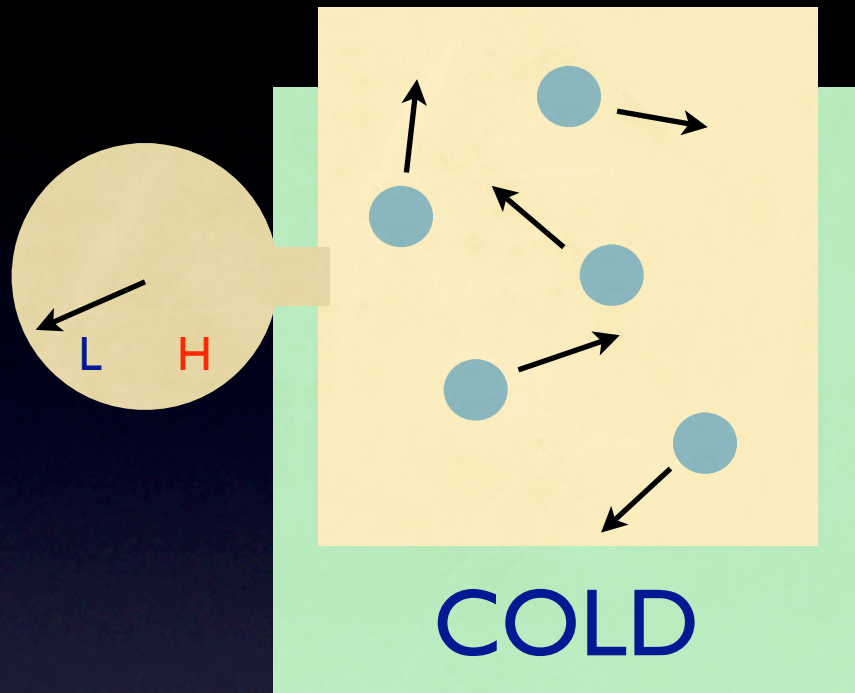
HIGHEST

THE AMOUNT OF GAS
(# OF PARTICLES)

How does temperature affect gas pressure?

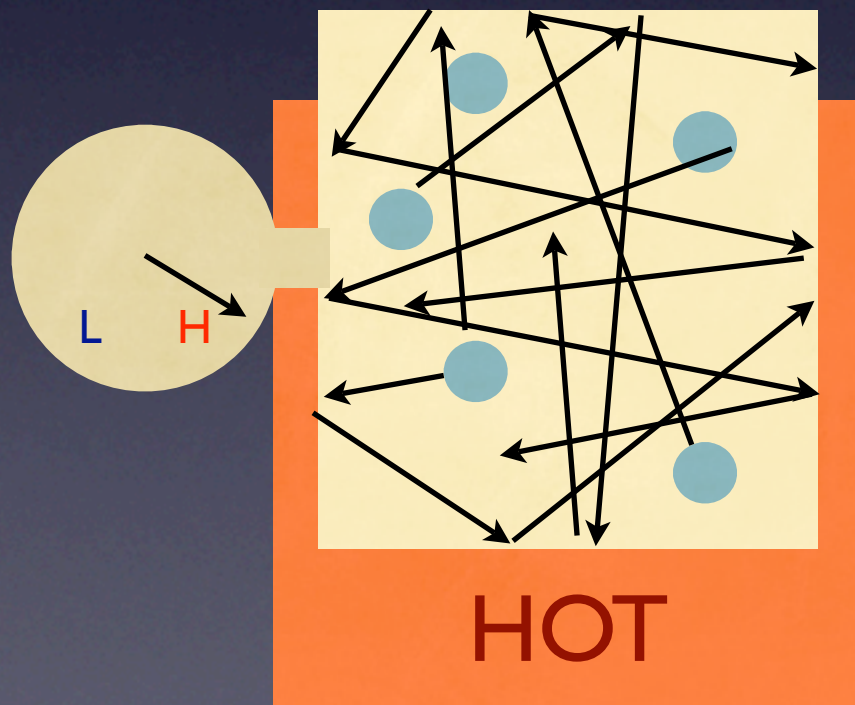


How does temperature affect gas pressure?

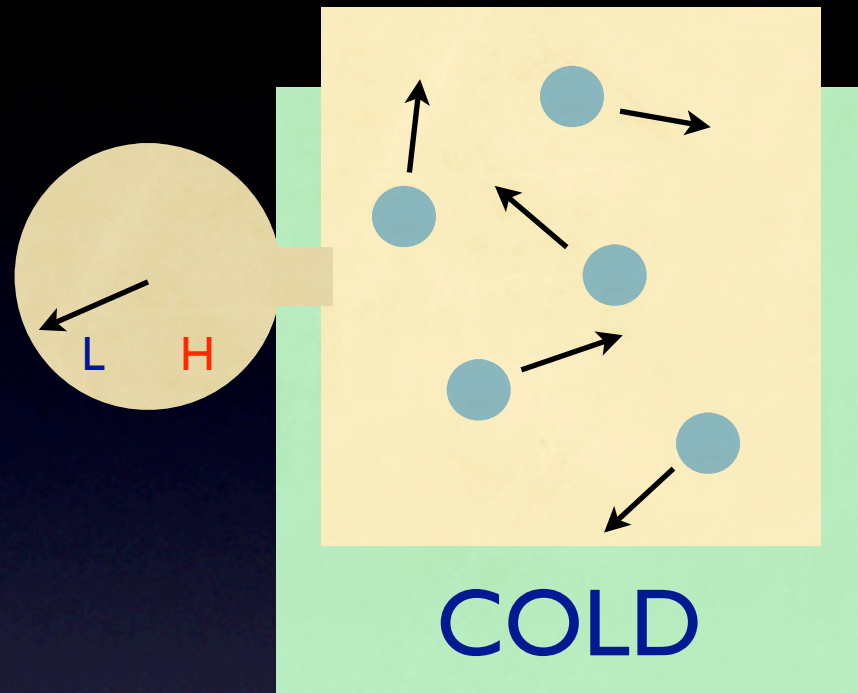


low temperature = low kinetic energy
= low number of collisions

= LOW PRESSURE

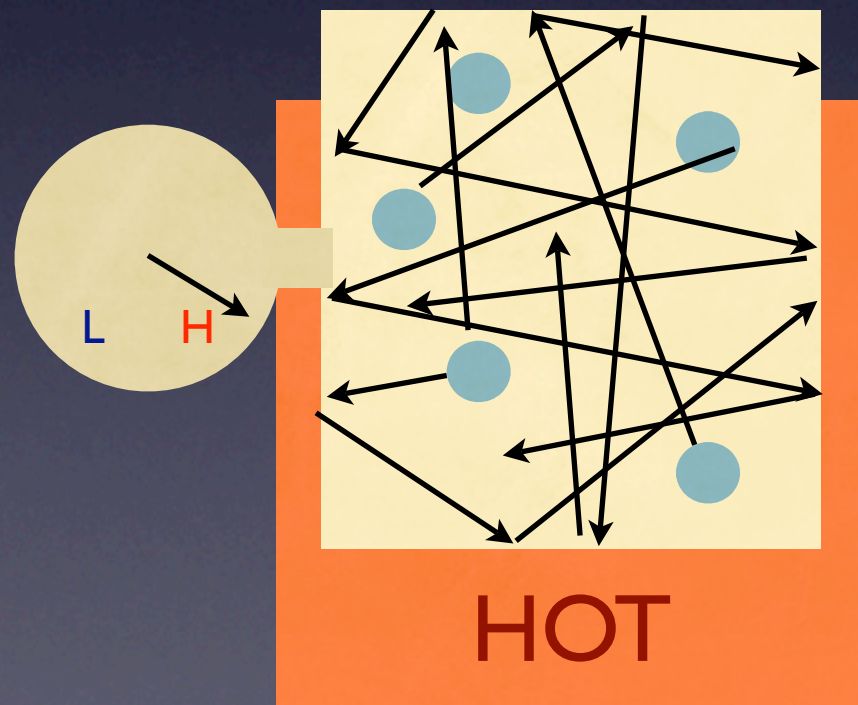


How does temperature affect gas pressure?



low temperature = low kinetic energy
= low number of collisions

= LOW PRESSURE



high temperature = high kinetic energy
= high number of collisions

= HIGH PRESSURE

SUMMARY: What factors affect gas pressure?

PROVE IT!!!

SUMMARY: What factors affect gas pressure?

volume

PROVE IT!!!

SUMMARY: What factors affect gas pressure?

volume

amount of gas

PROVE IT!!!

SUMMARY: What factors affect gas pressure?

volume

amount of gas

temperature

PROVE IT!!!

How are volume and pressure in a gas related?



demo!

How are volume and pressure in a gas related?



Increase pressure

demo!

How are volume and pressure in a gas related?



Increase pressure →

demo!

How are volume and pressure in a gas related?



Increase pressure →
decrease volume

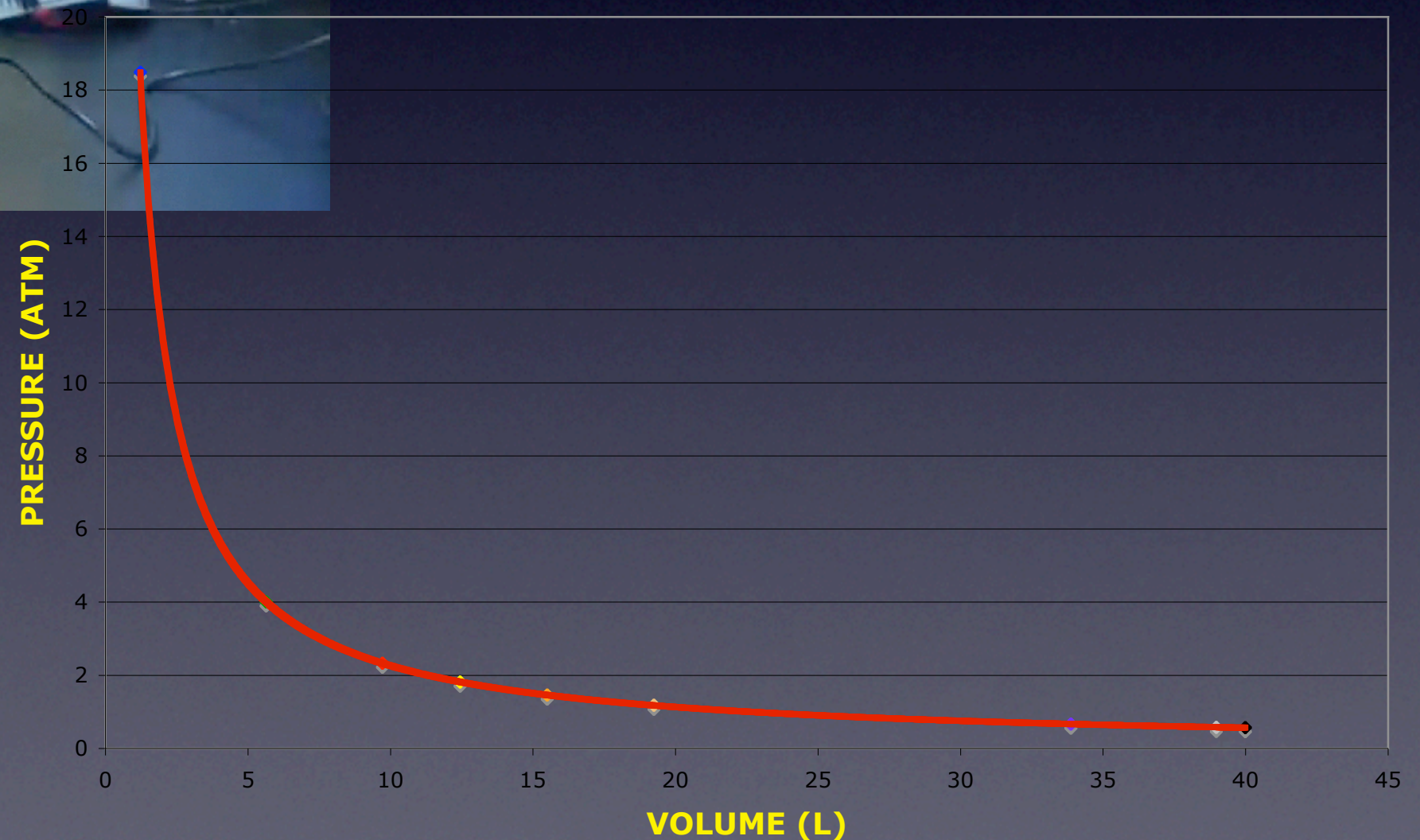
demo!

How are volume and pressure in a gas related?



Increase pressure →
decrease volume

PRESSURE VS. VOLUME



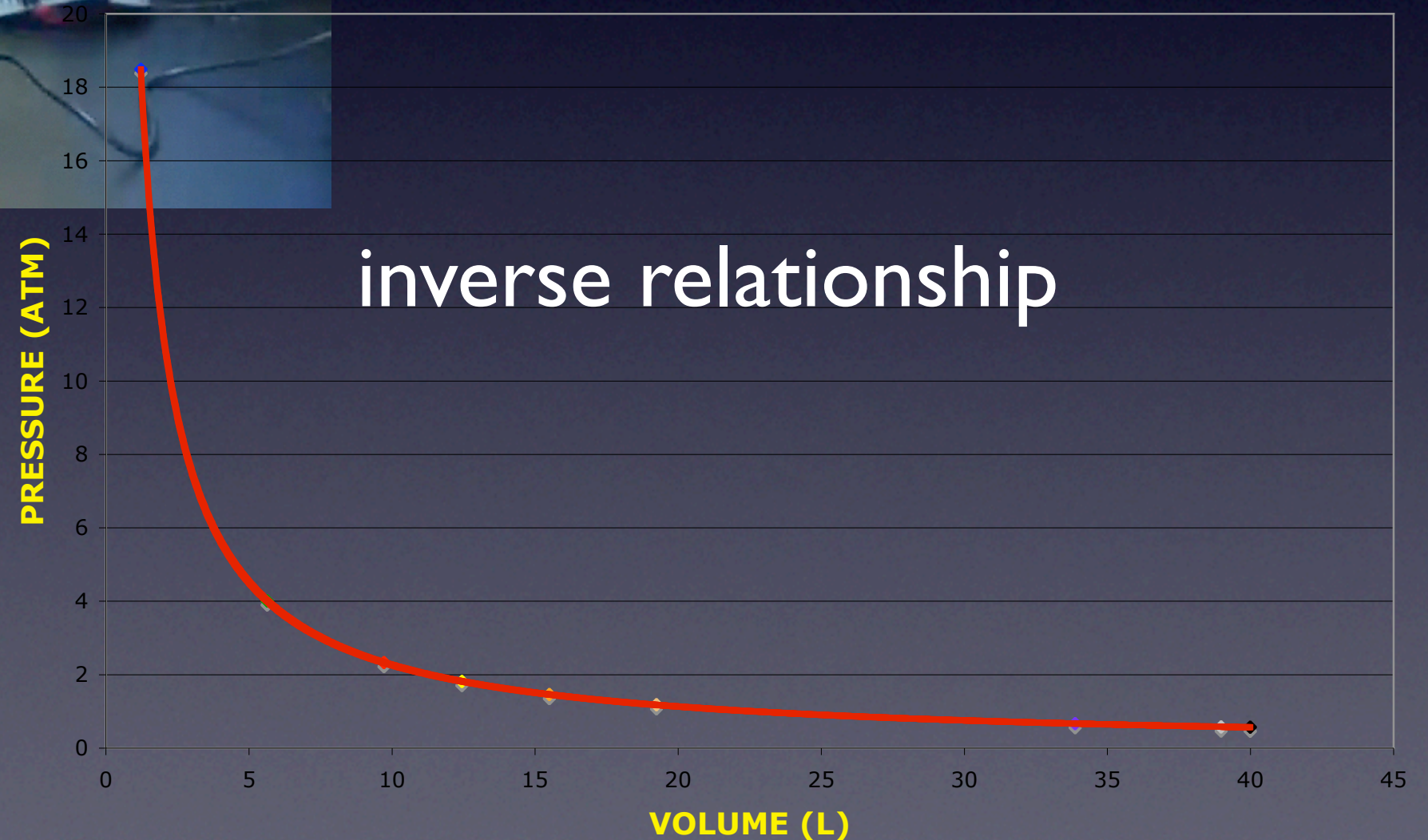
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How are volume and pressure in a gas related?



Increase pressure →
decrease volume

PRESSURE VS. VOLUME



demo!

How are volume and pressure in a gas related?

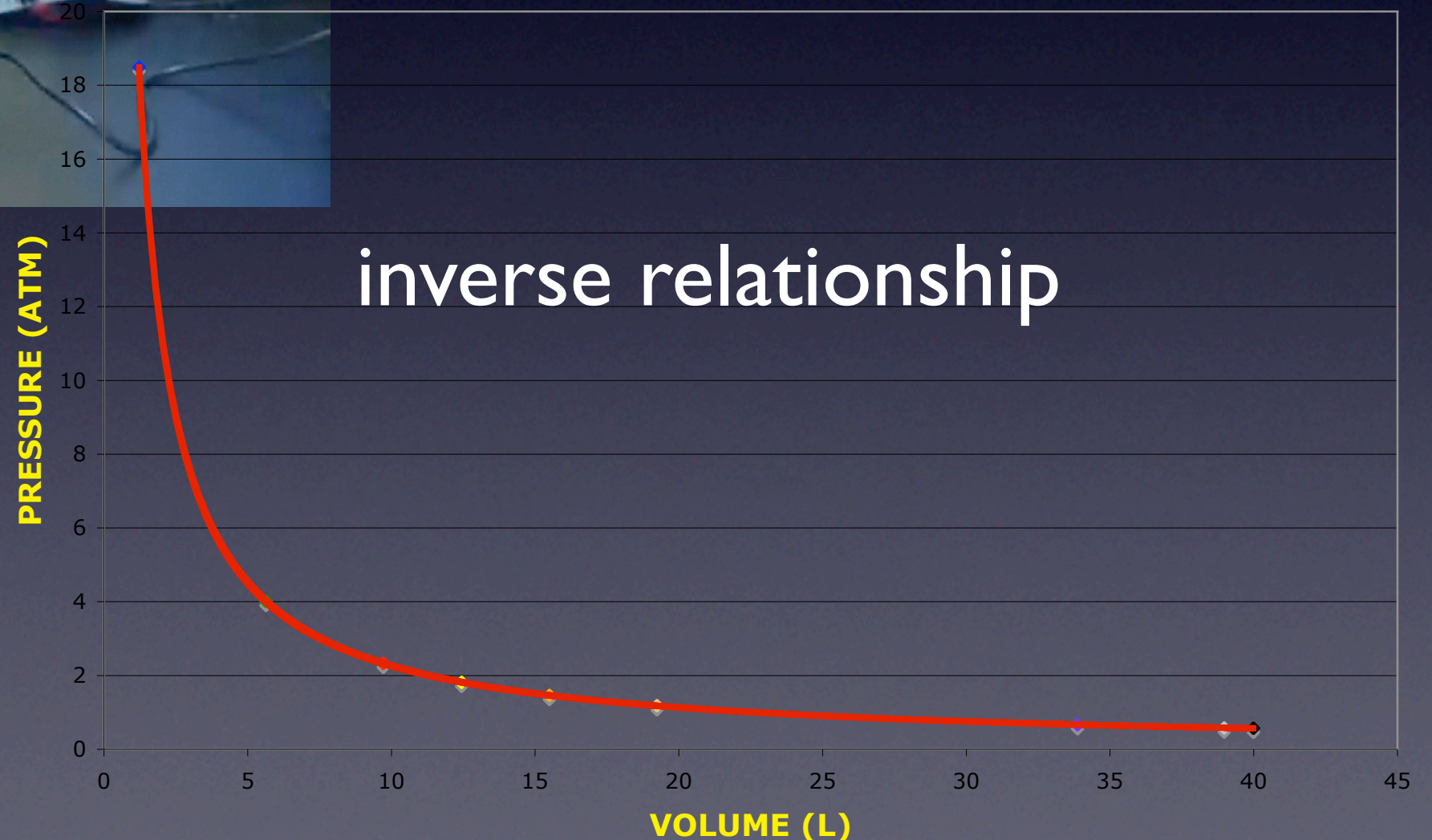


Increase pressure →
decrease volume

PRESSURE VS. VOLUME

BOYLE'S LAW

demo!



How are volume and pressure in a gas related?



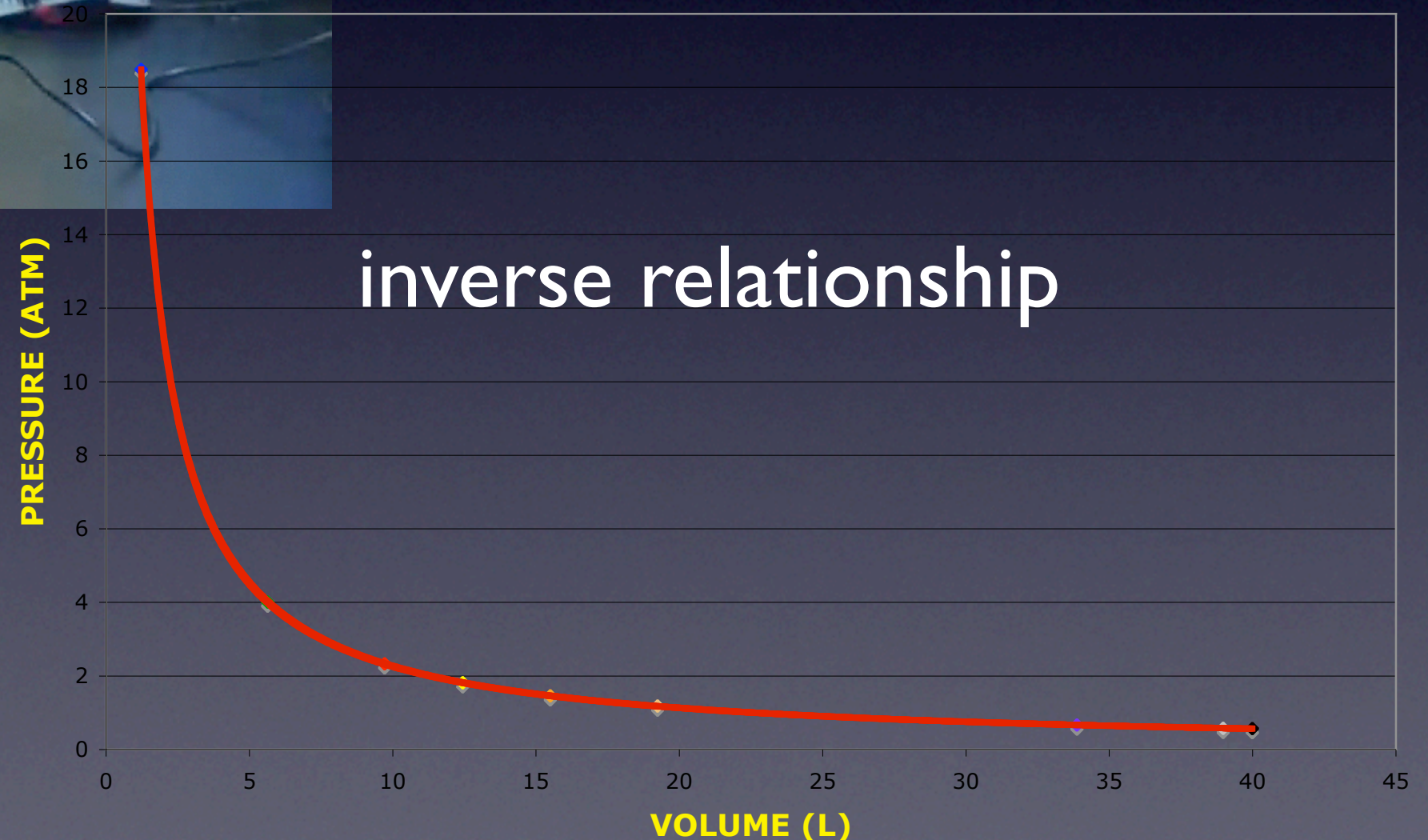
Increase pressure →
decrease volume

PRESSURE VS. VOLUME

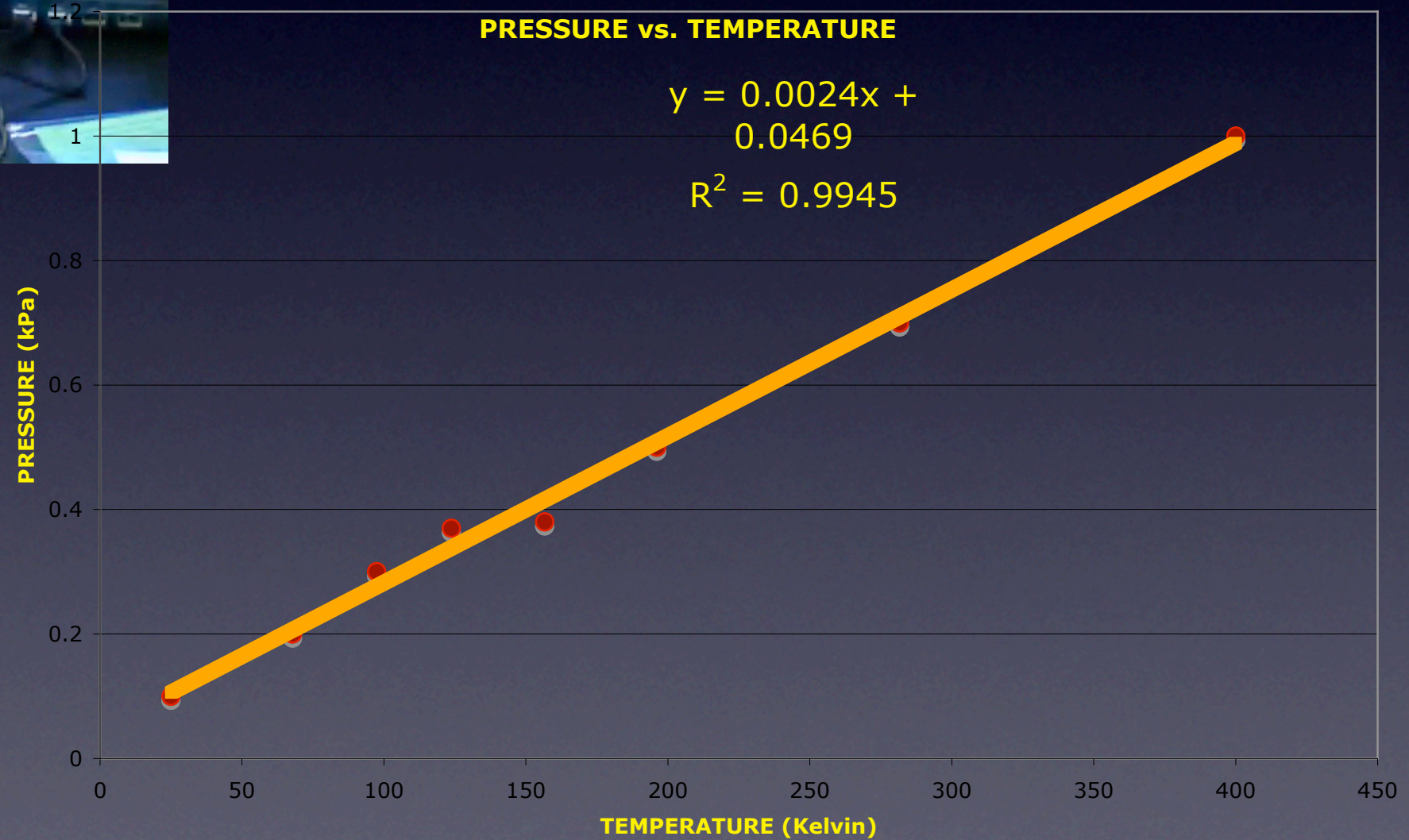
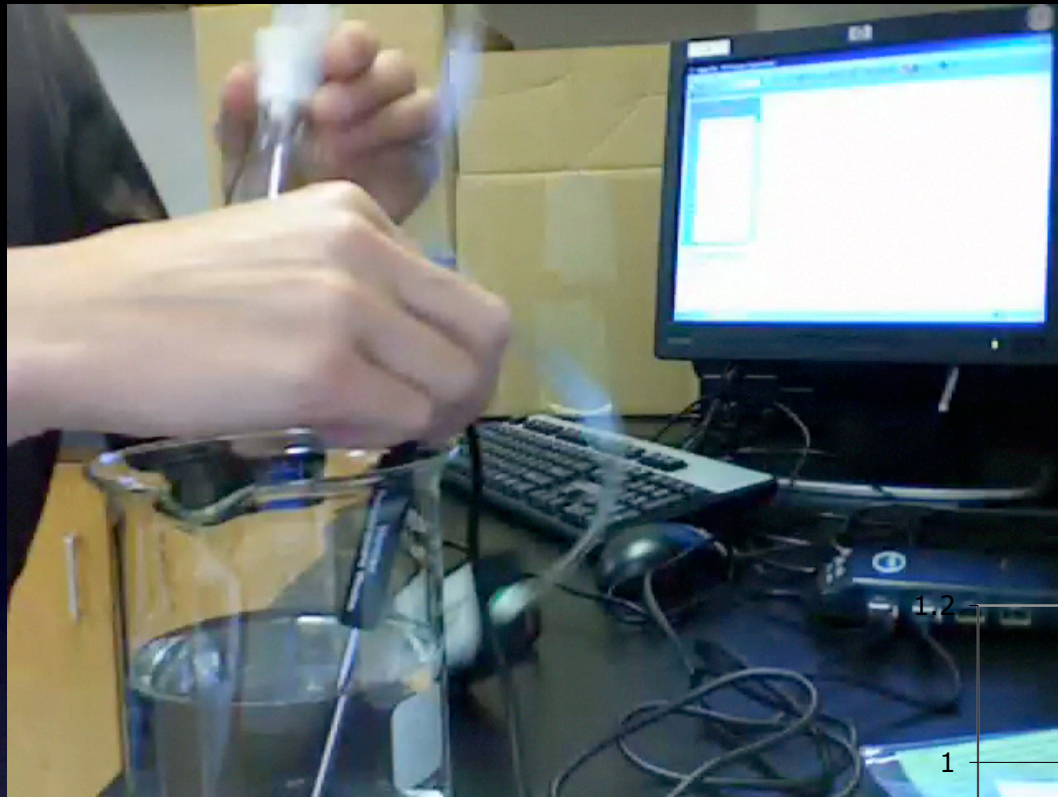
BOYLE'S LAW

$$P_1V_1 = P_2V_2$$

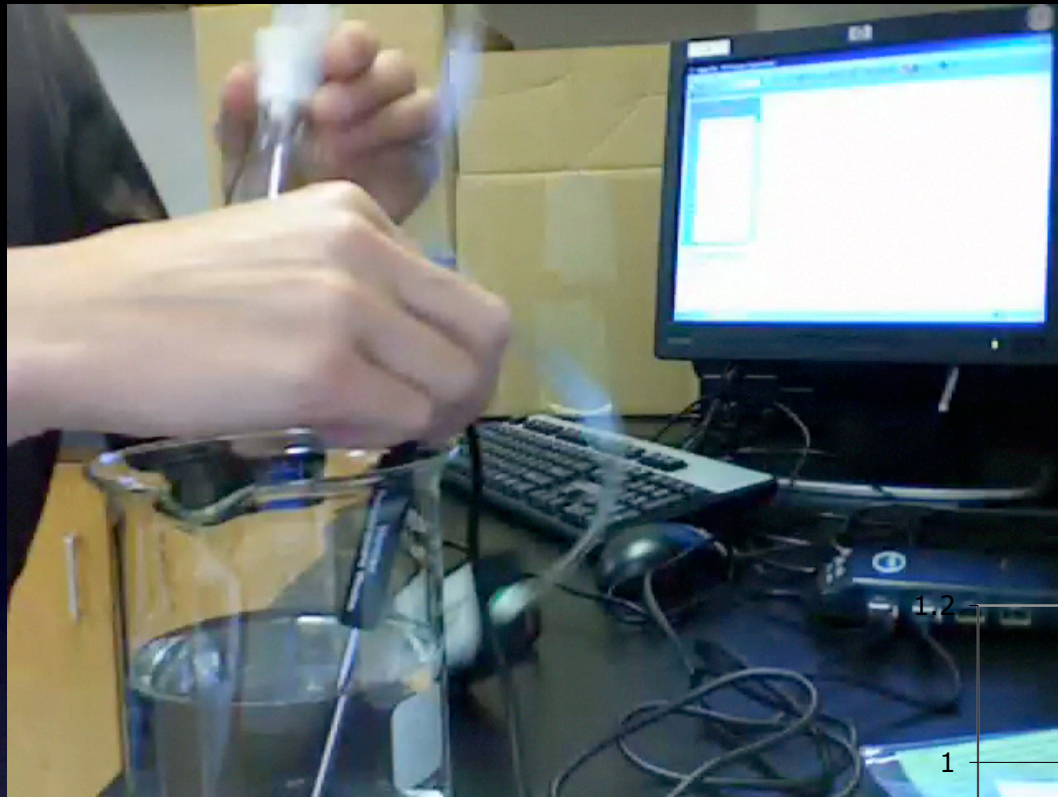
demo!



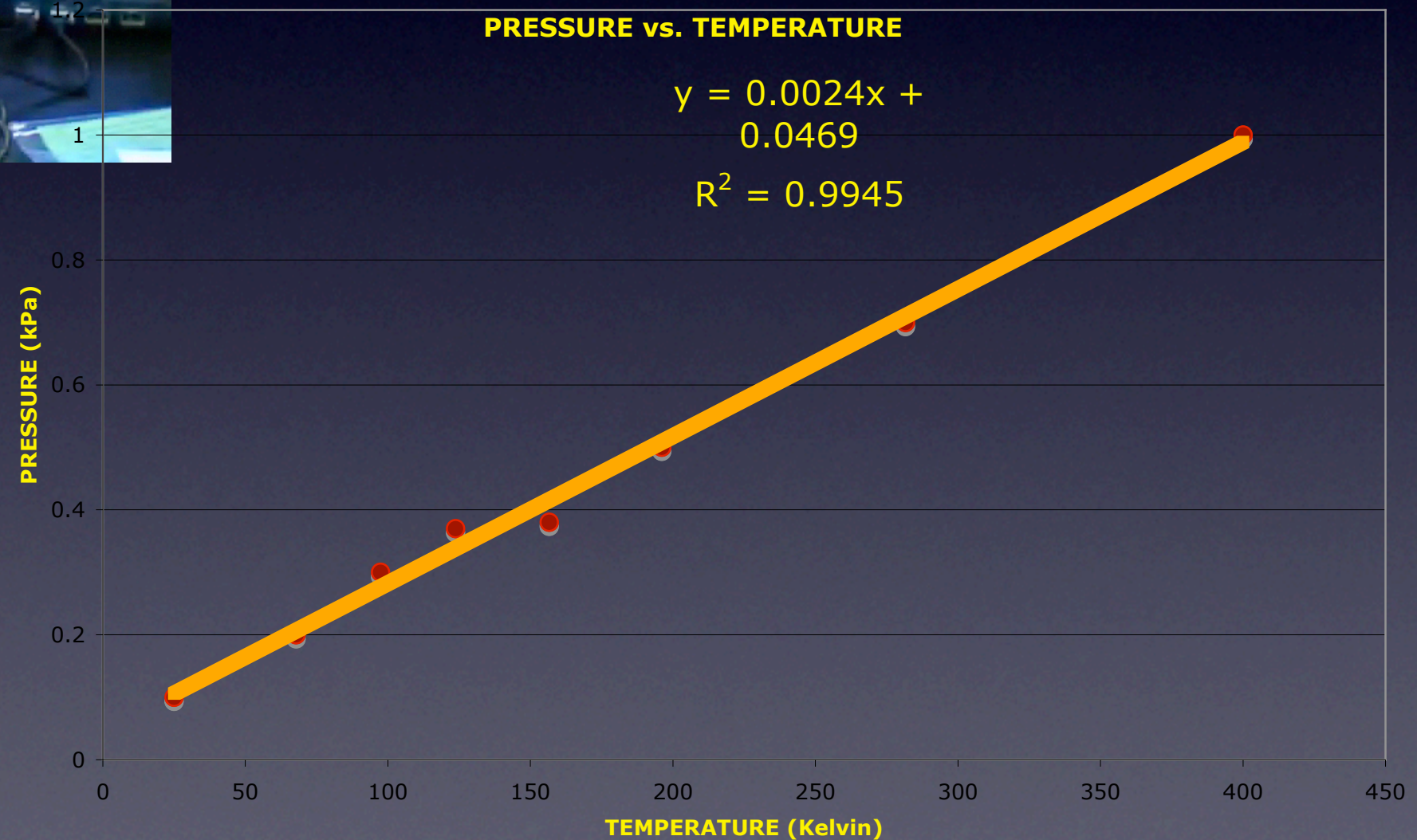
How are temperature and pressure in a gas related?



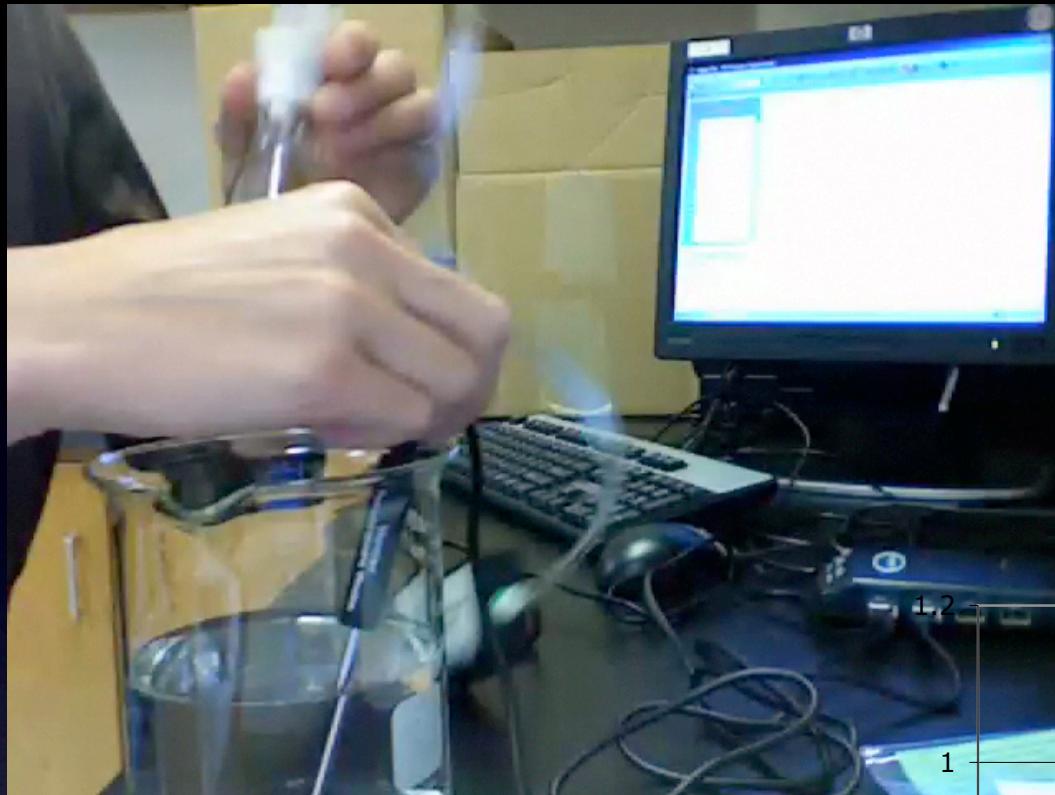
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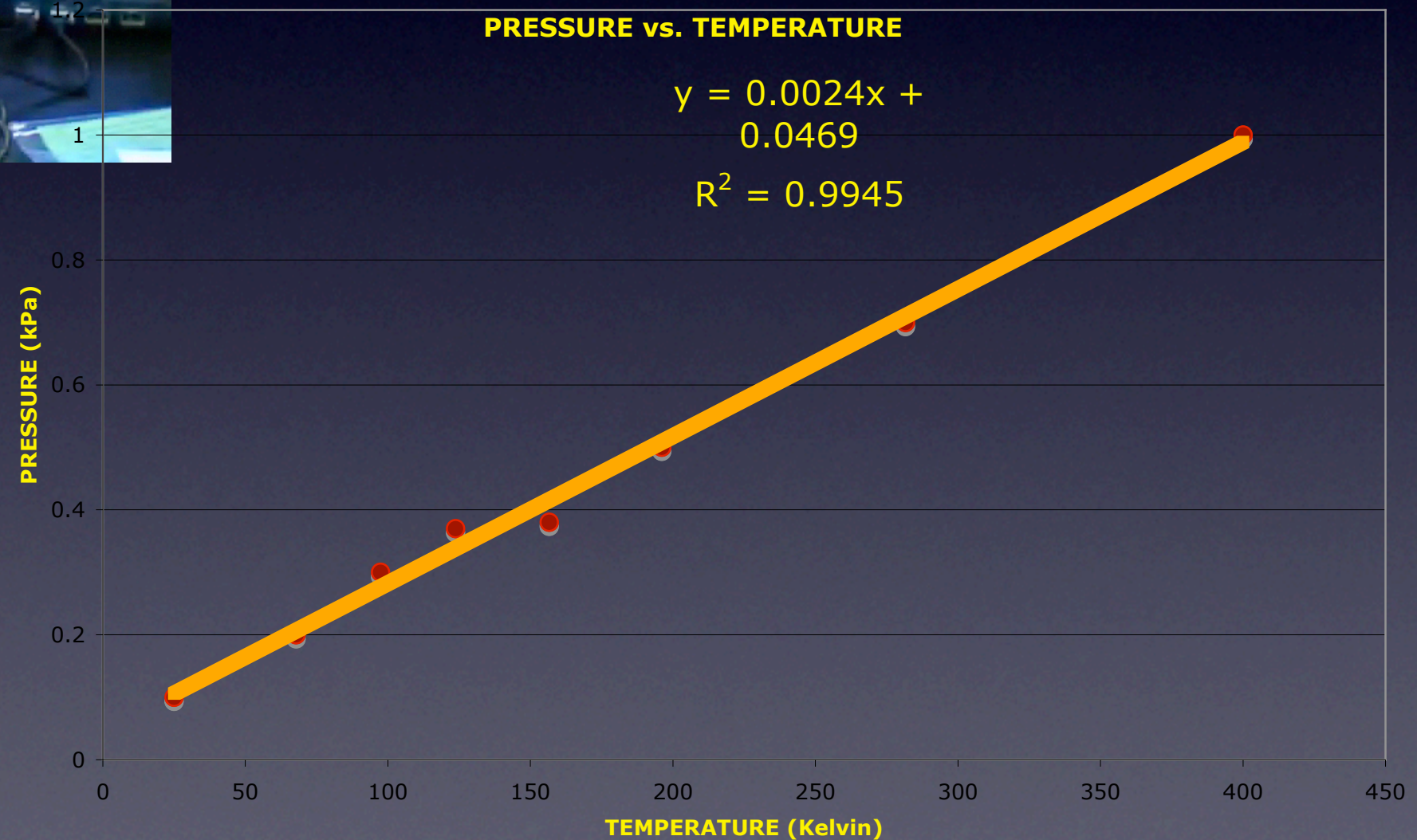
Increase temperature...



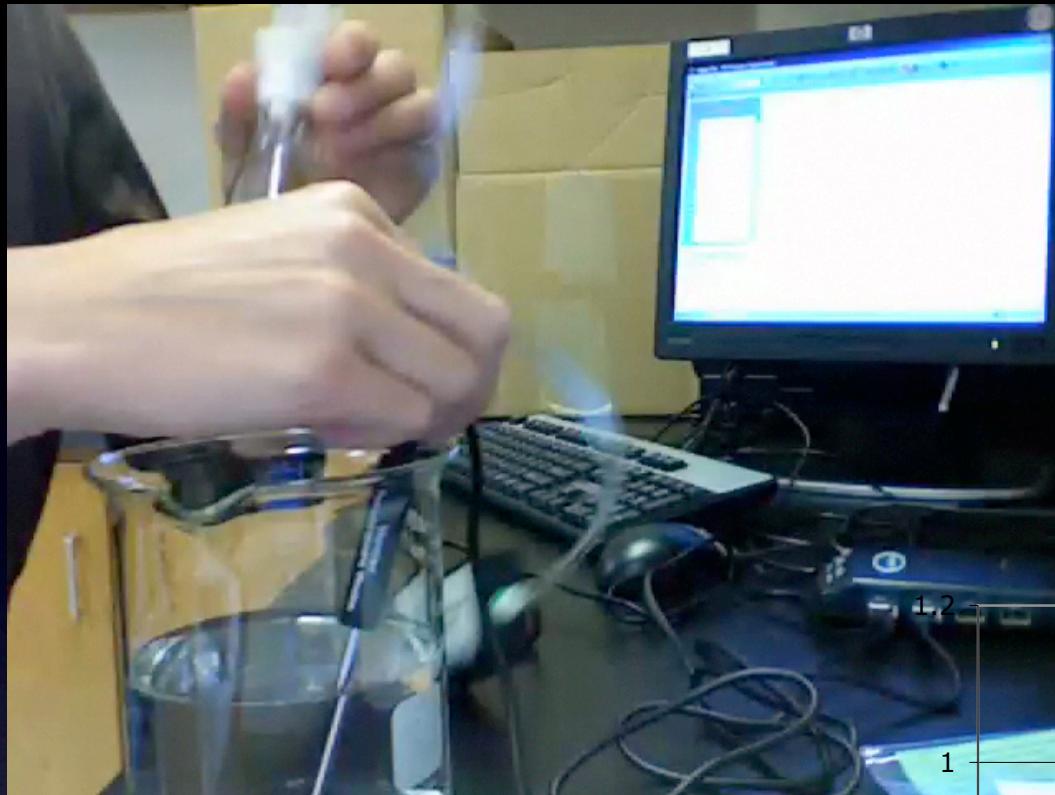
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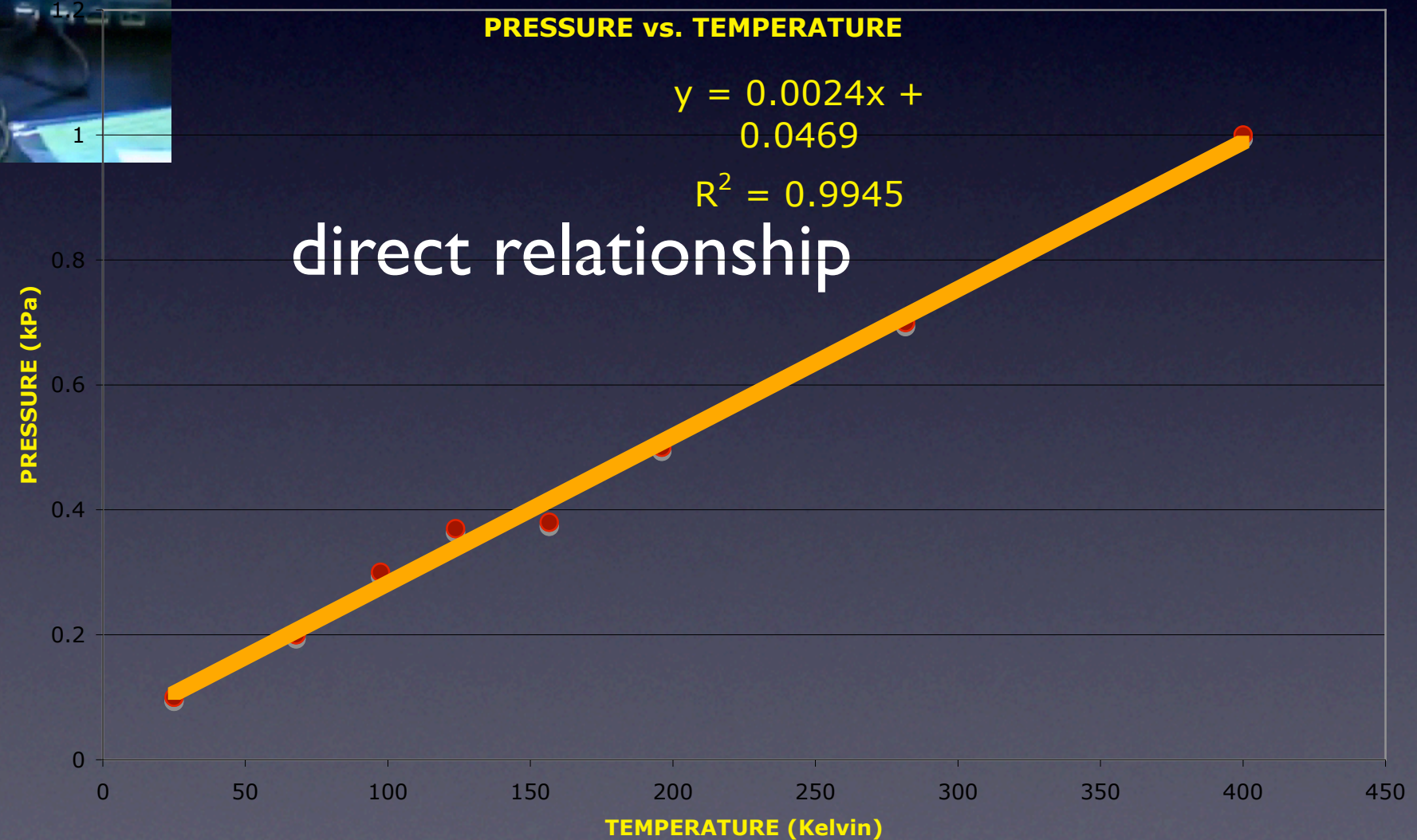
Increase temperature...
increase pressure!



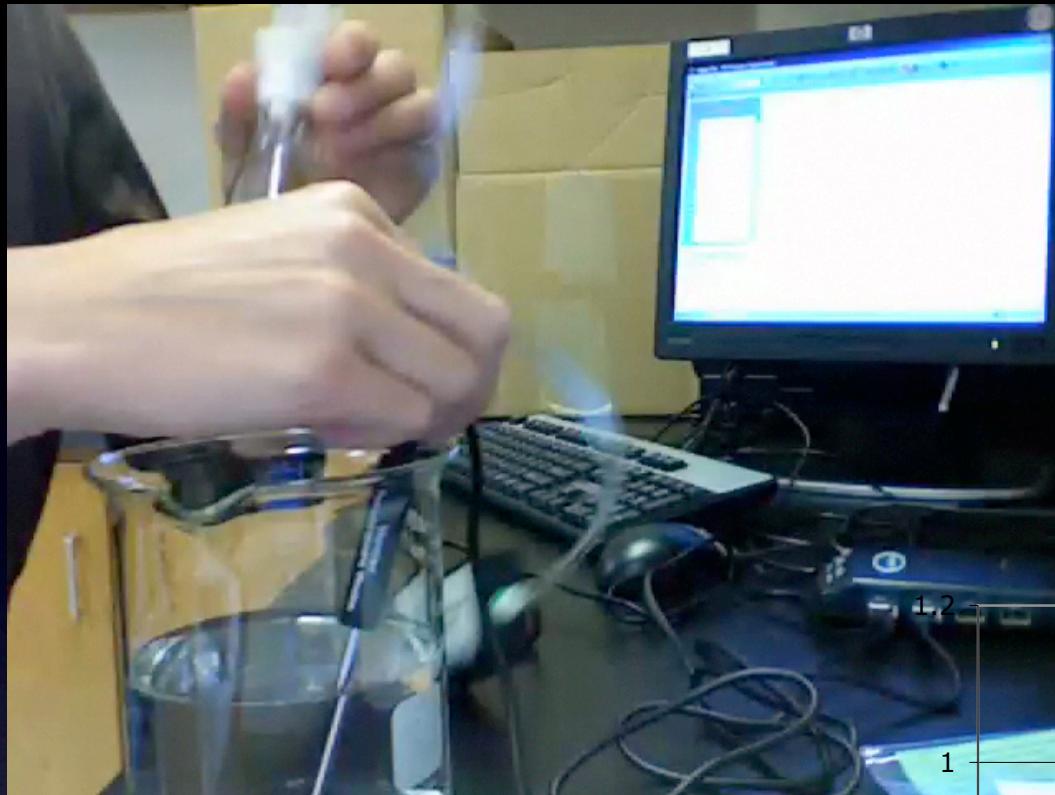
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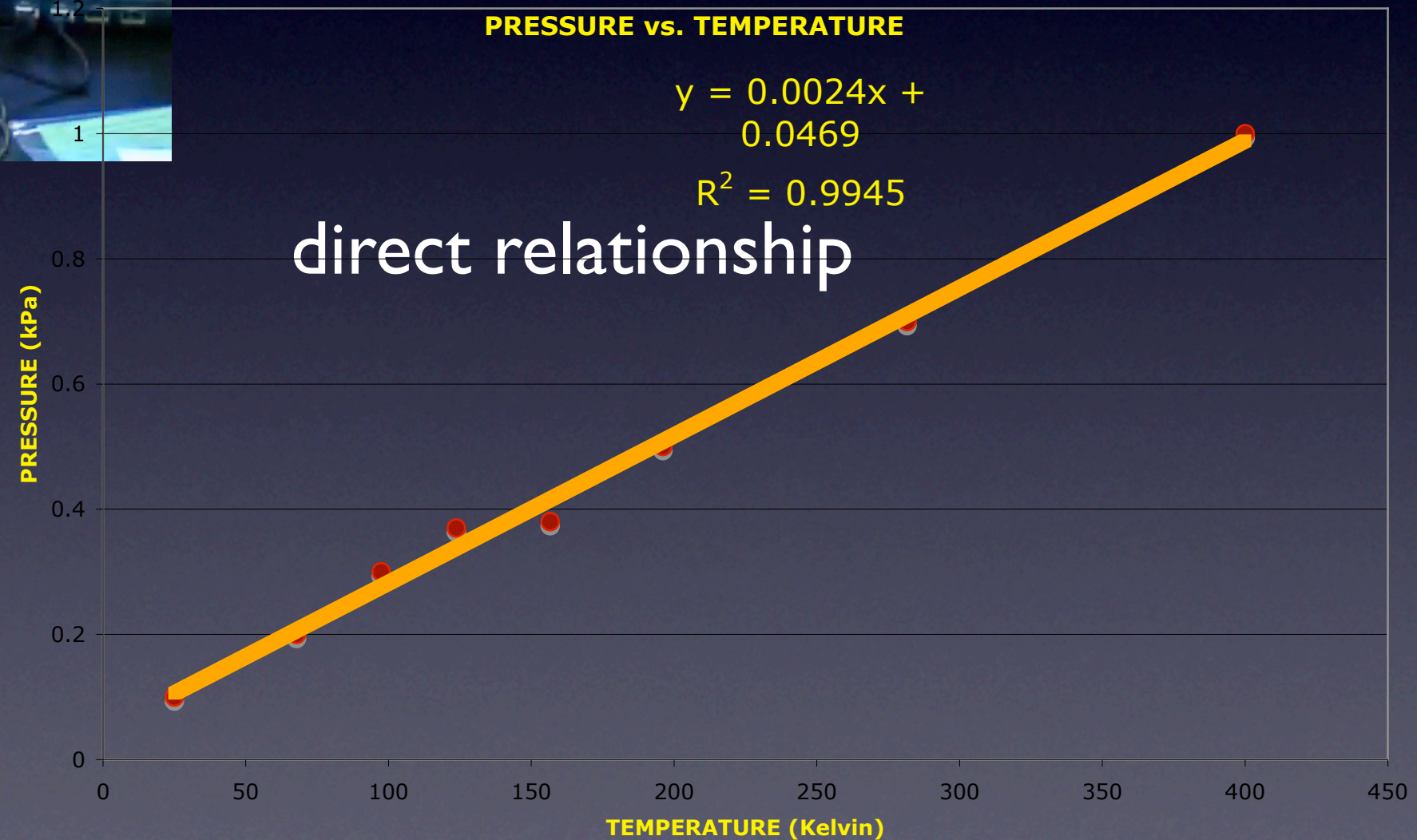


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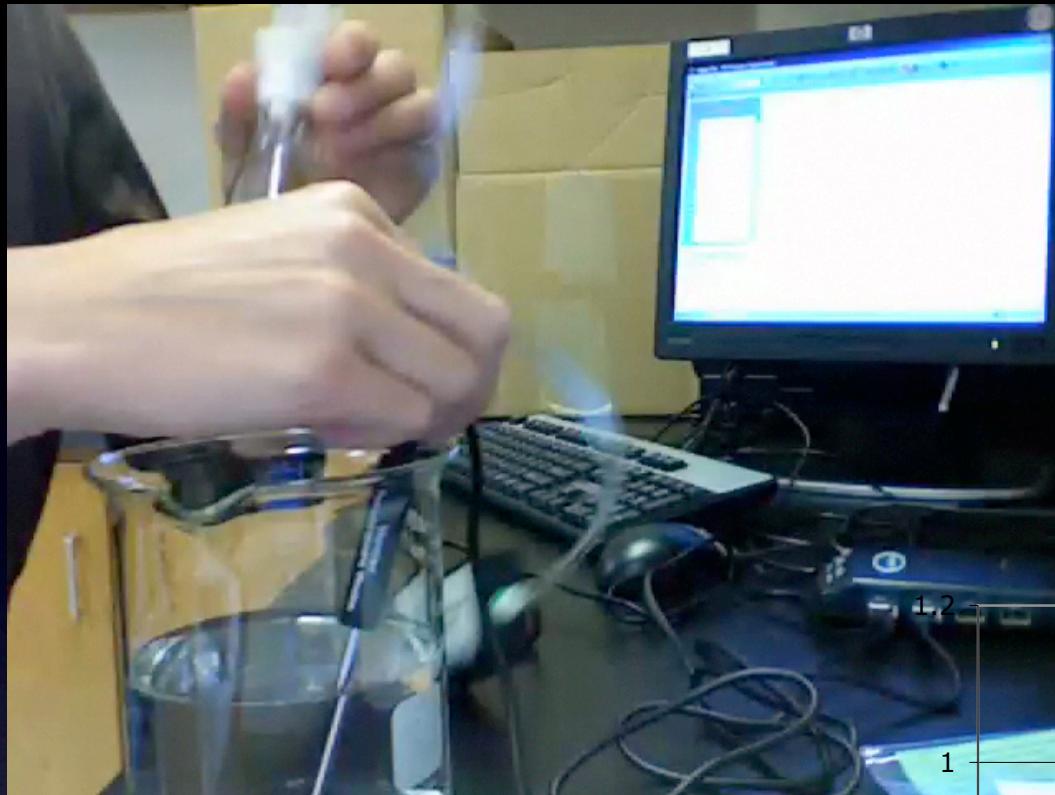


Increase temperature...
increase pressure!

Gay-Lussac's
Law



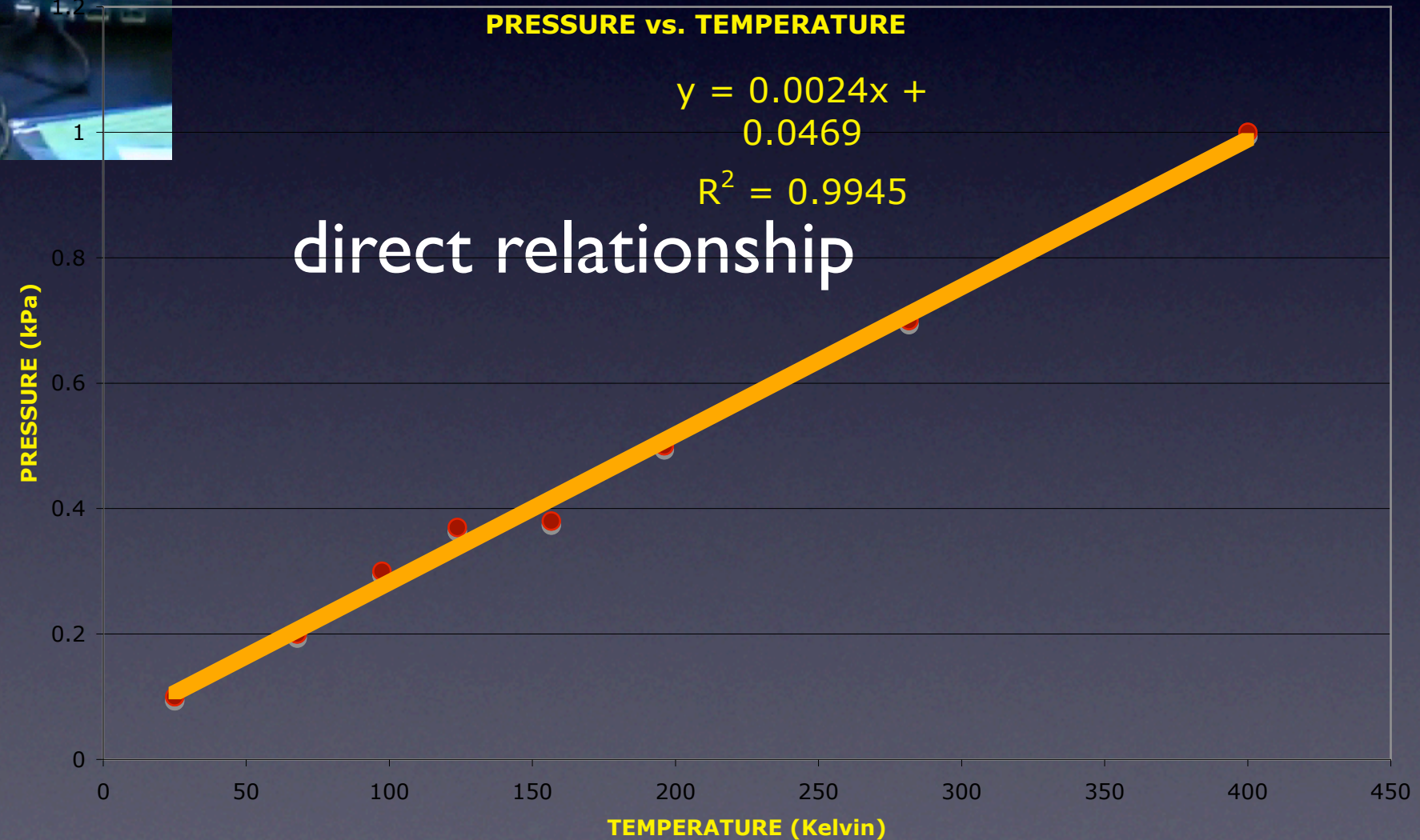
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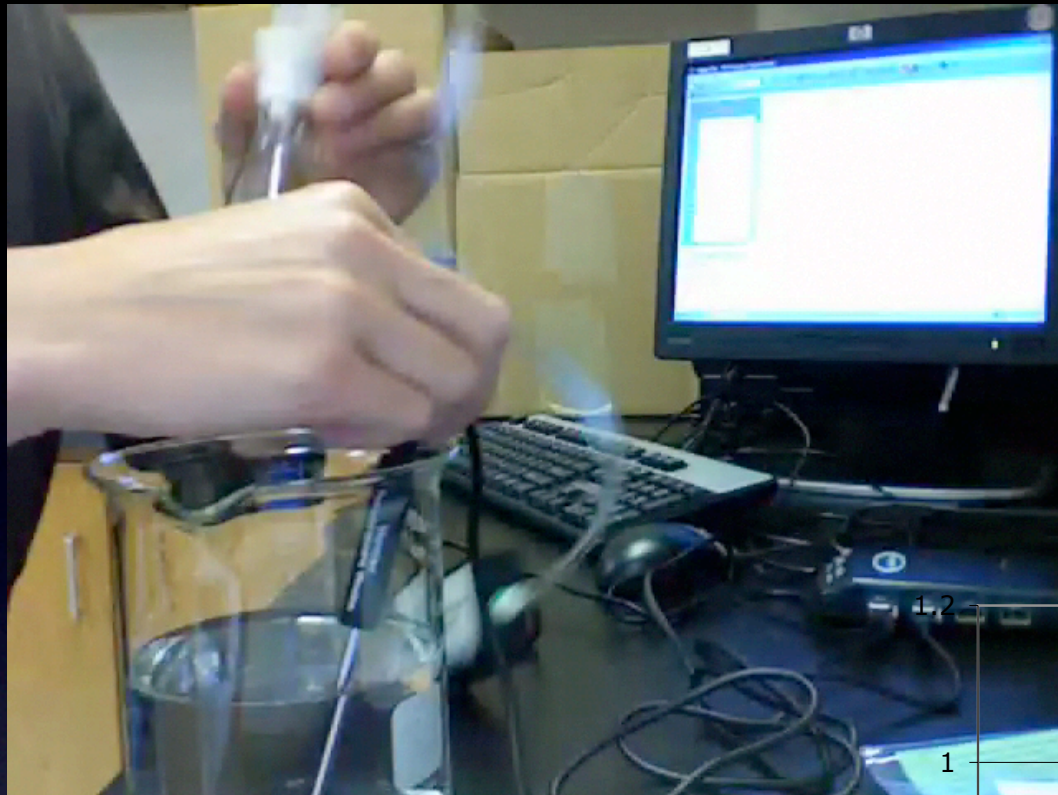
Increase temperature...
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$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$



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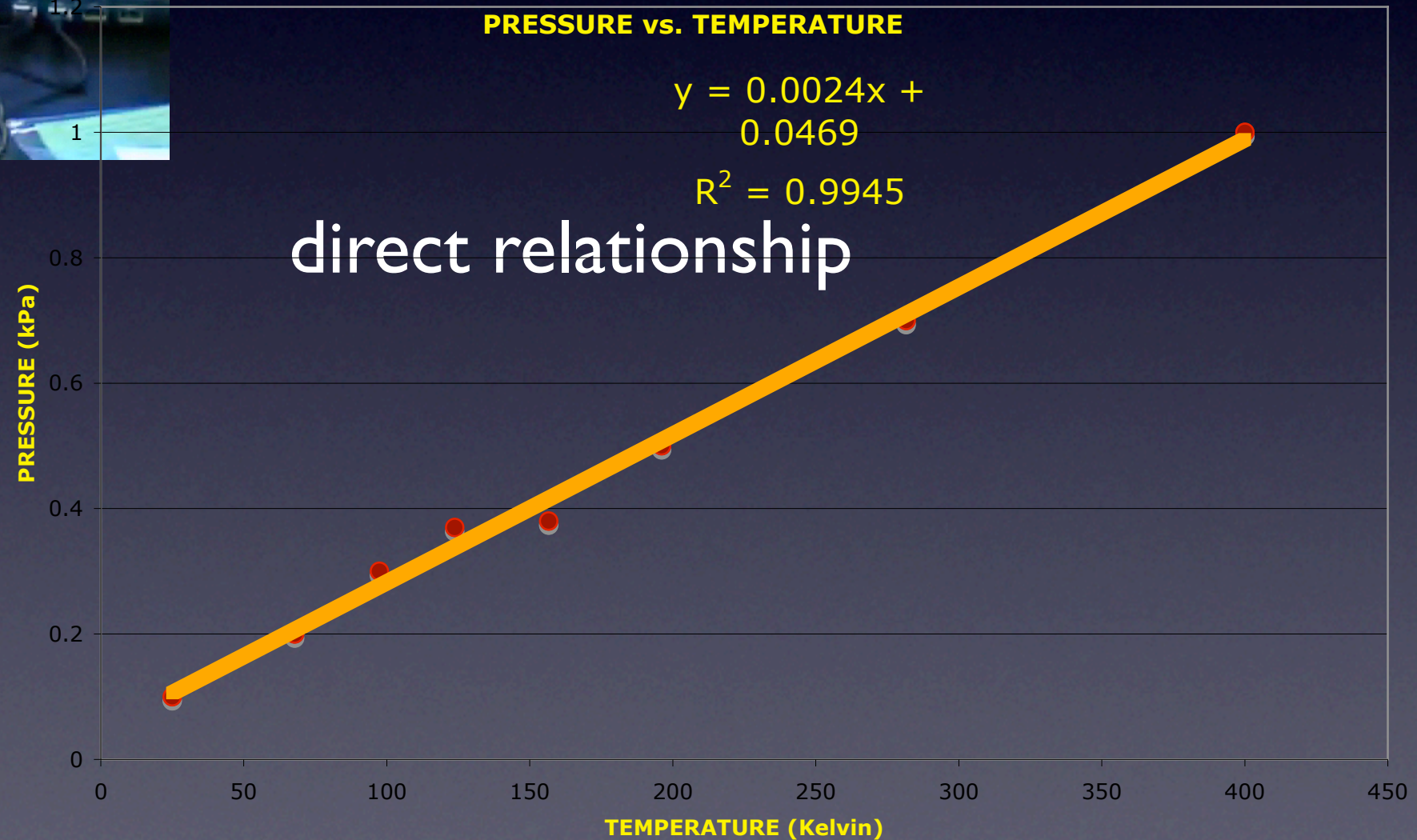


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demo!



How are temperature and volume in a gas related?

How are temperature and volume in a gas related?

decrease temperature...

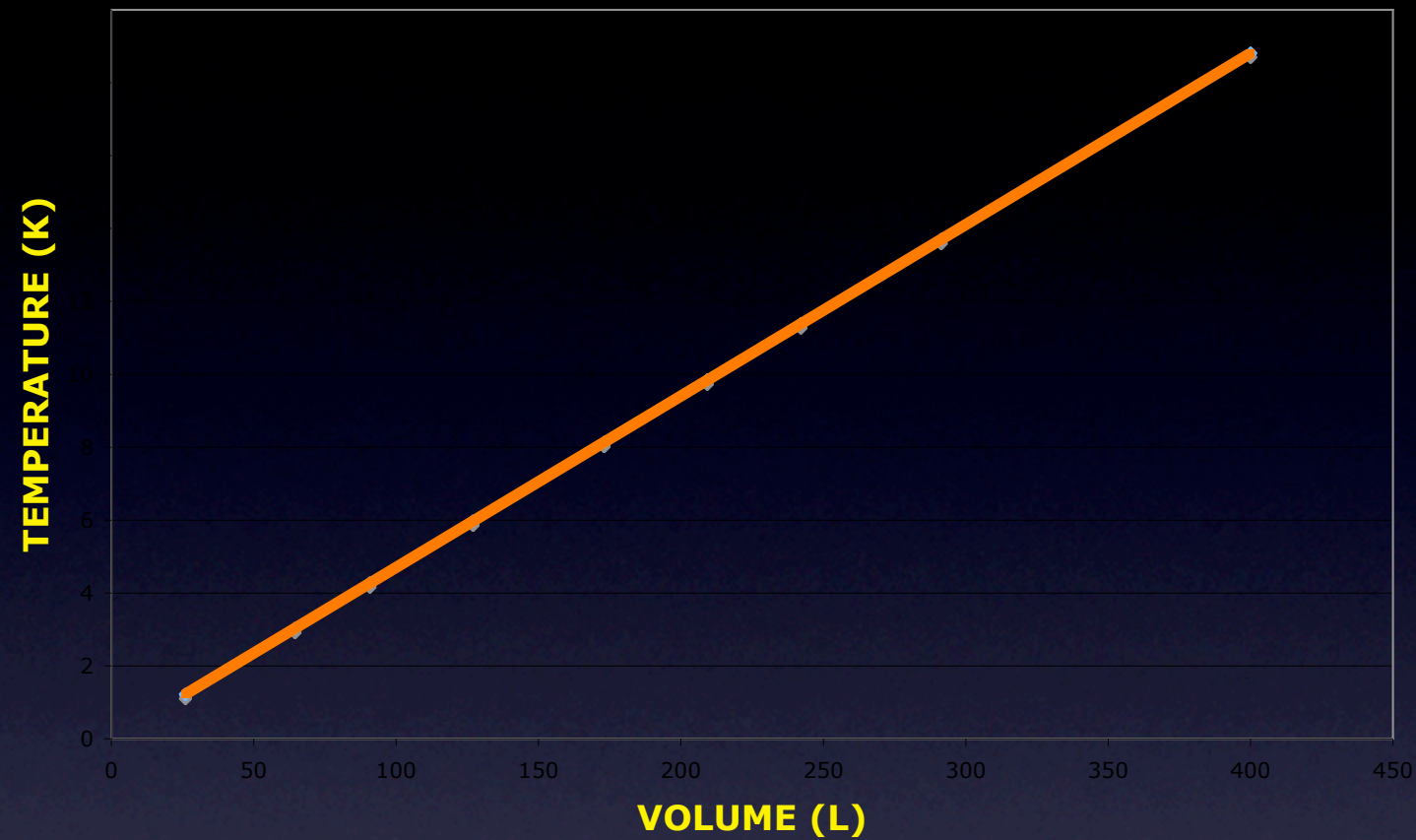
How are temperature and volume in a gas related?

decrease temperature...

decrease volume

How are temperature and volume in a gas related?

VOLUME VS. TEMPERATURE

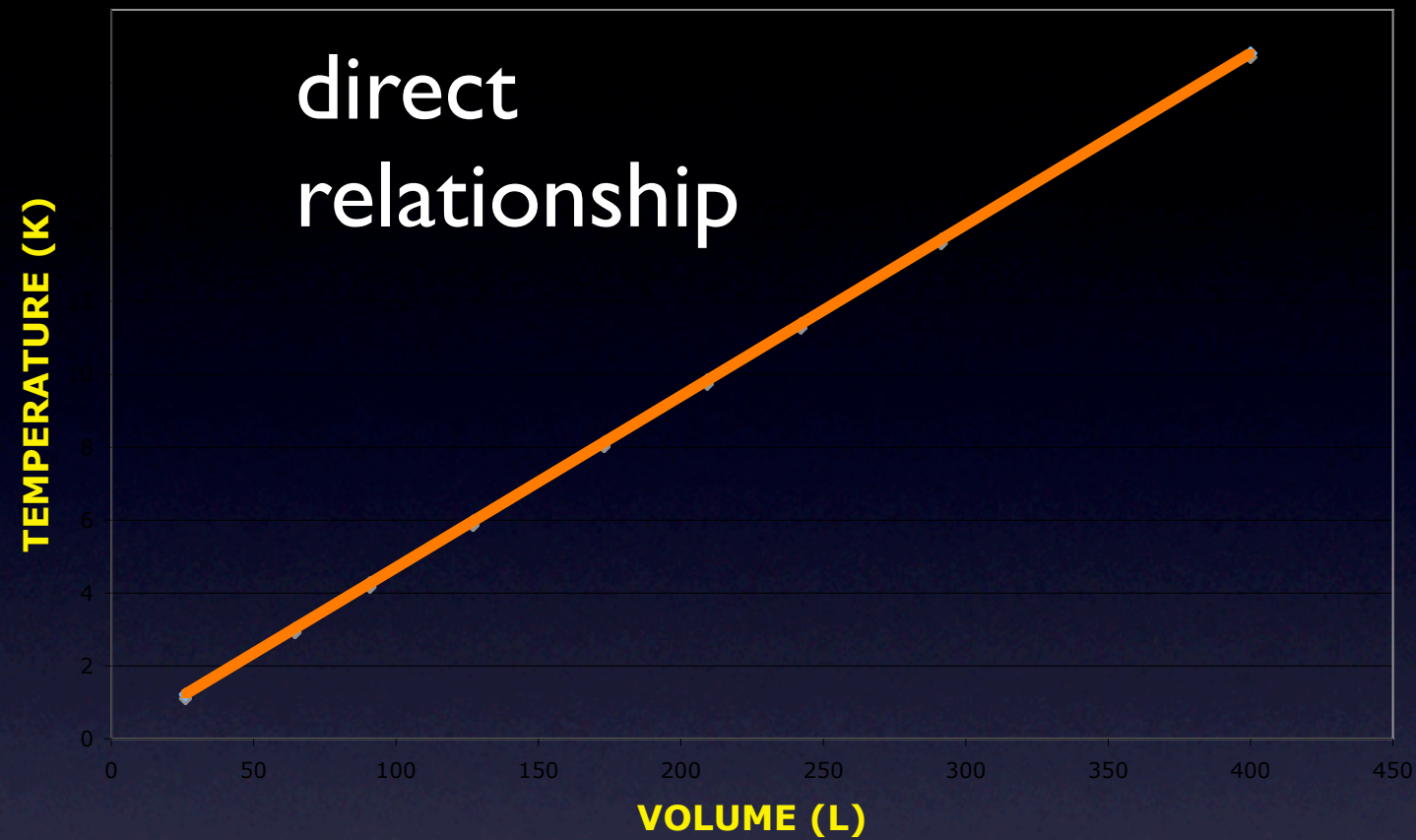


decrease temperature...

decrease volume

How are temperature and volume in a gas related?

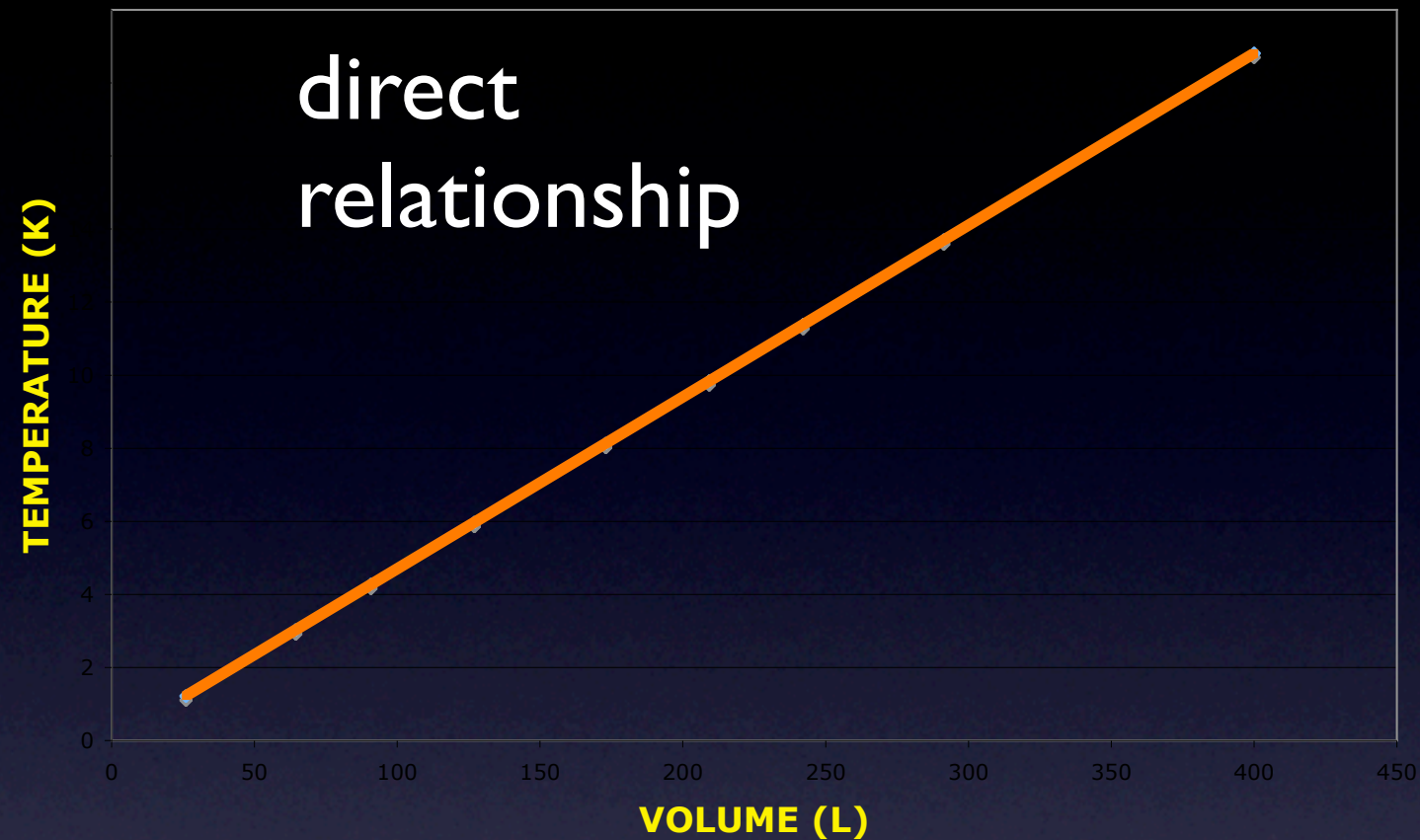
VOLUME VS. TEMPERATURE



decrease temperature...
decrease volume

How are temperature and volume in a gas related?

VOLUME VS. TEMPERATURE



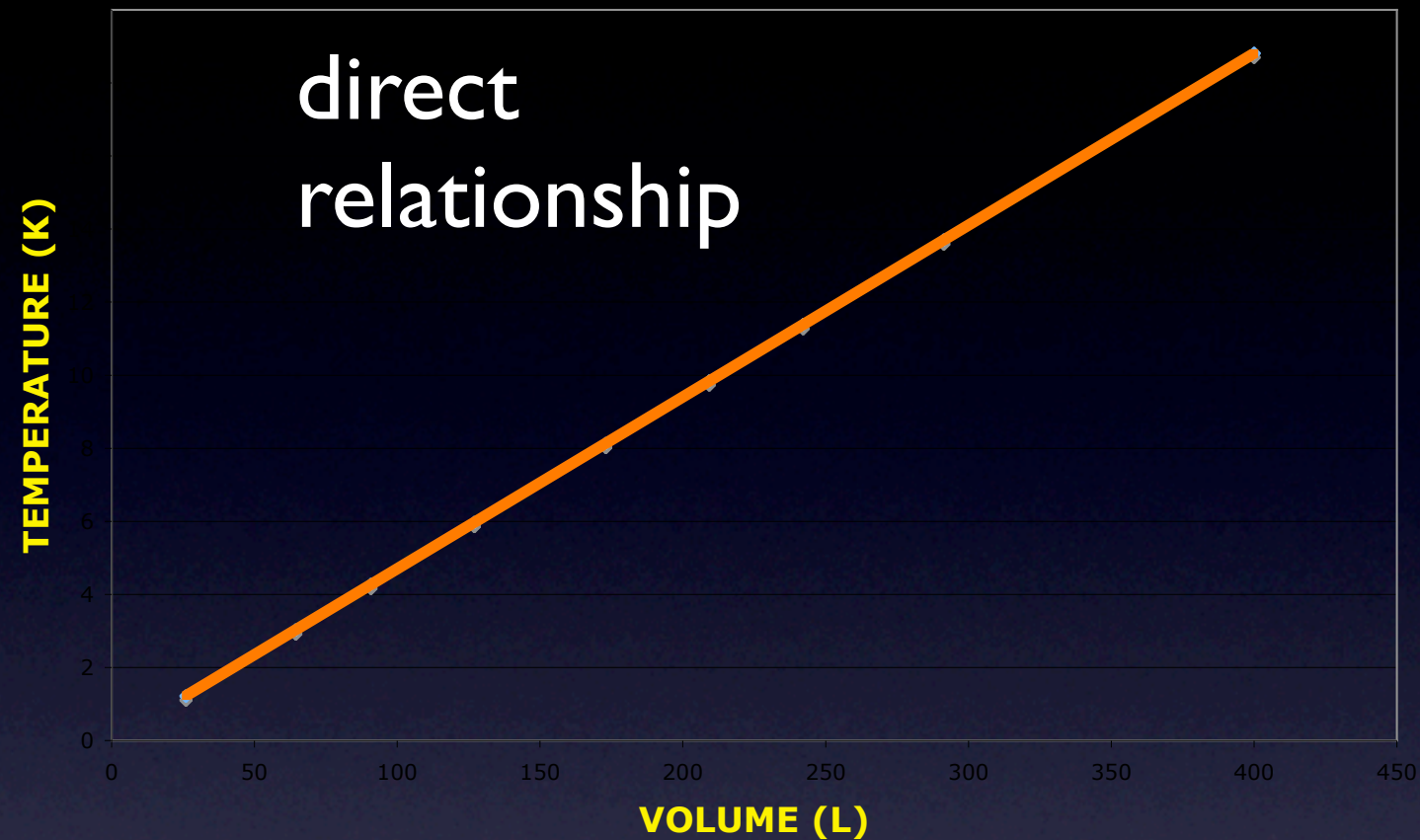
decrease temperature...

decrease volume

CHARLES' LAW

How are temperature and volume in a gas related?

VOLUME VS. TEMPERATURE



decrease temperature...

decrease volume

CHARLES' LAW

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$